JULY 1955

Power Engineering

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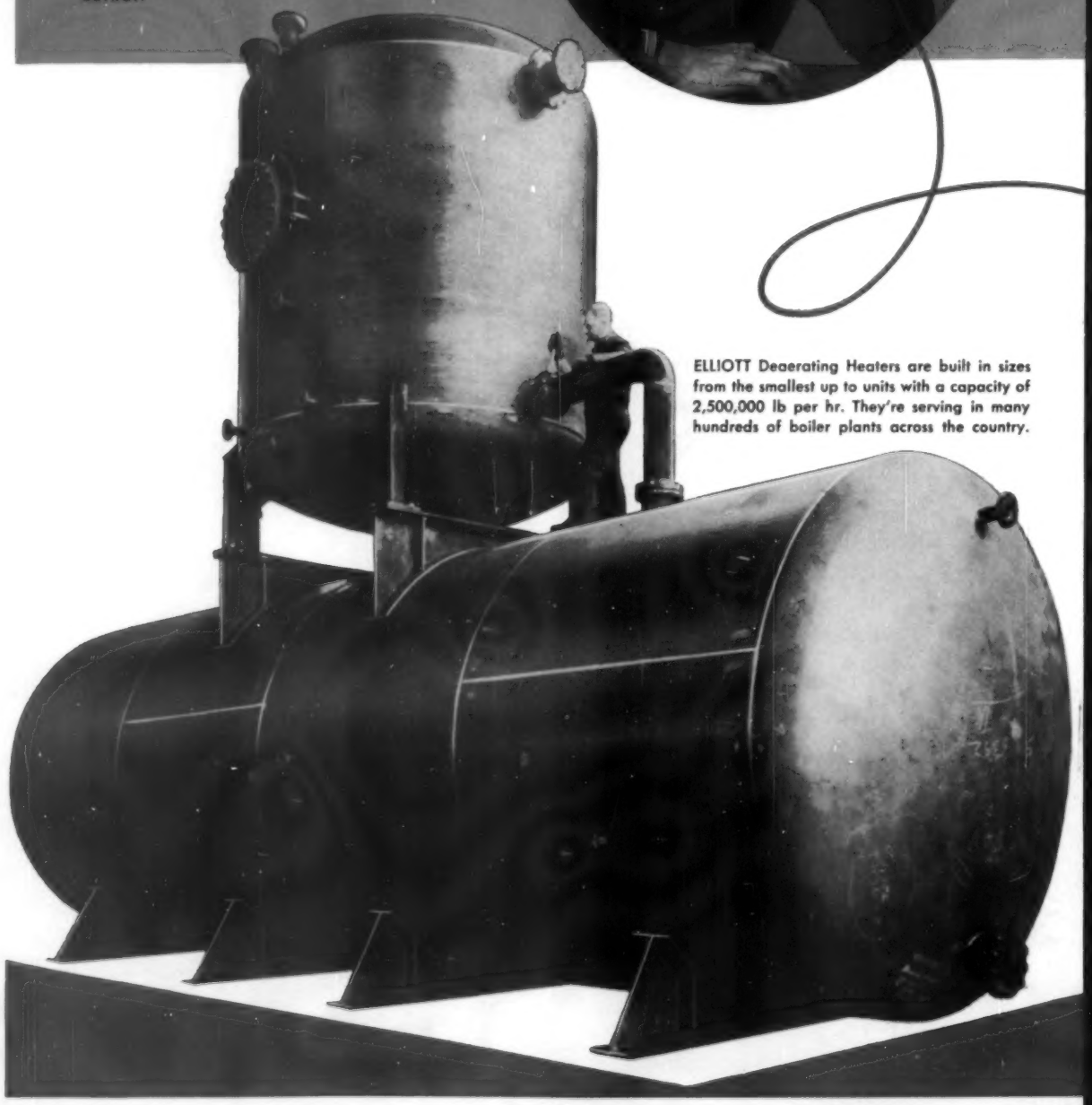

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1. **THE ELLIOTT SALES ENGINEER.** He's factory-trained and thoroughly grounded in the principles of deaeration and their practical application. He can give your engineers valuable aid in the selection of the right deaerating equipment for your needs and in the solution of feedwater deaerating problems. You can reach him at the nearest of the district offices listed.

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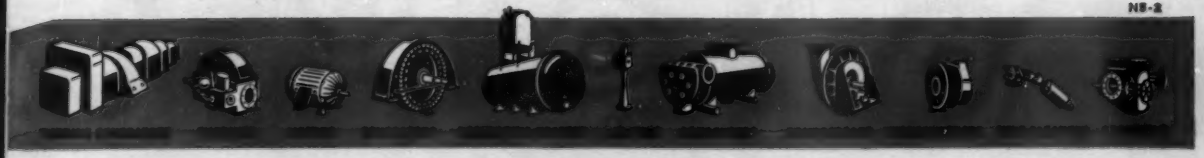
WRITE FOR BULLETINS. Bulletin N-18 covers the science of deaeration in detail. Bulletin N-19 shows how Elliott deaerating feedwater heaters satisfy every one of the requirements.

ELLIOTT Company

NB-2



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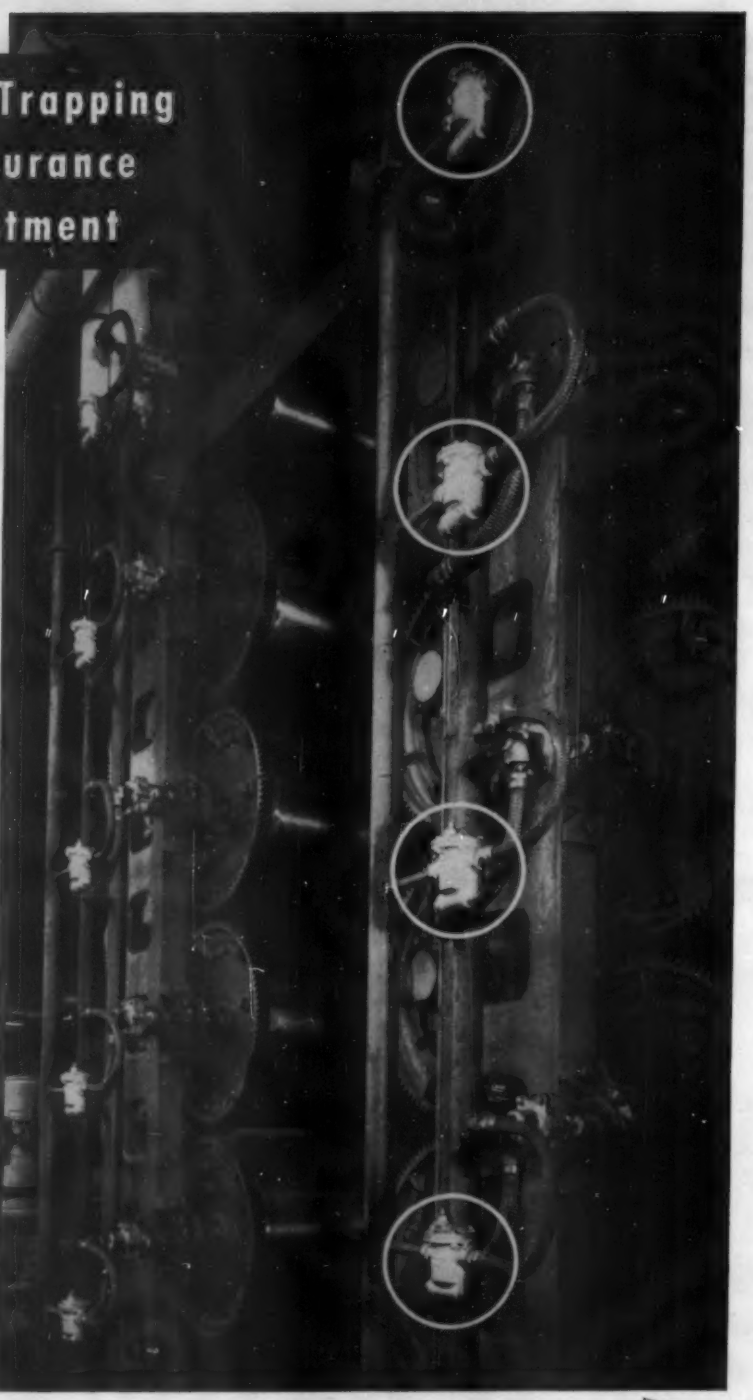
Armstrong Unit Trapping —Low Cost Insurance of a Big Investment



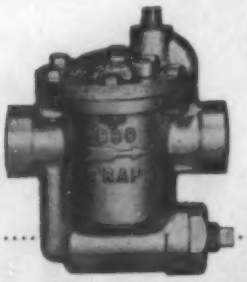
● *30% more production from kettles . . . 84 degrees higher dryer temperatures . . . 8% more output from dry kiln*—these are typical results of unit trapping with Armstrongs.

What about your plant? It doesn't make good business sense to spend $500, $5000 or $50,000 for equipment and then lose 10% to 30% or more of its productivity for lack of proper trapping.

Armstrong traps are "application engineered" by men who know trapping thoroughly—how to size traps for fast heat-up and top temperatures . . . correct installation practice . . . steam supply and return line requirements . . . variable pressure problems . . . mysterious difficulties. The cost of retrapping with Armstrongs is usually but a fraction of 1% of the cost of the equipment drained—*low cost insurance of a big investment!*

Call your Armstrong Representative today. He sells on a basis of "satisfaction or your money back." Or, write:

ARMSTRONG MACHINE WORKS
810 Maple St., Three Rivers, Mich.



Armstrong built-in strainer traps, pictured on textile dry cans at the right, cost less to buy and install than standard traps and separate strainers—they reduce maintenance and costly shutdowns. Three sizes, ½" or ¾" connections.

SEND FOR FREE STEAM TRAP BOOK . . .

. . . 44 pages of how-to-do-it data. Useful and educational. Free on request without obligation.

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ARMSTRONG STEAM TRAPS

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ENGINEERS' PREVIEW

We Are Looking for Editors

POWER ENGINEERING is expanding and will have openings for graduate engineers in the mechanical or electrical field with a good solid background of operating, design, and construction experience. If you like to travel, meet people, learn of new developments, investigate new ideas, and if you have imagination, ingenuity and tact, together with a reasonable command of the King's English, you will find this interesting work. There are several openings, but the immediate one has the following specifications:

A graduate engineer from 45 to 50 years of age, who has gone through a cadet or student engineer's course with one of the public utilities, spent a number of years in the operating department, two or three years in the power sales department, and a number of years as power engineer with industrial companies, and who holds a professional engineer's license.

Not all engineers like to be editors, but the engineers who are editors feel it is a great profession. If you meet the specifications, or, as a potential associate editor, can fit into one of the several steps in the specifications, will you write, giving complete details of your education and experience, to an engineer who has been in the business for a generation? Write to the Editor, POWER ENGINEERING, 110 South Dearborn St., Chicago 3, Ill.

AUTOMATION — Friend or Foe? That is a question a great many industries and a great many of the workers in those industries are asking today. It is also the title of an interesting Employee Relations News Letter issued by General Electric Co. In brief, it demonstrates that despite all the alarm about this new development, automation is definitely friend and not foe. To those of us in the power industry, where we have had a very high degree of automation for a great many years, the jitters of many people about this subject seem rather strange. Yet the doubts are understandable, considering that most people's ideas of the subject are formed from rumors and popularized discussion, rather than by getting down to the technical questions involved. In any case, General Electric explains how it views automation and why it considers it a good and necessary development. You can get a copy of this News Letter by writing to Employee and Plant Community Relations, Services Division, General Electric Co., New York City.

. . .

EXTENSIVE DISCUSSION of tube-to-tubesheet welding for heat exchangers is featured in the Spring, 1955 issue of the *Alco Products Review*, published by American Locomotive Co. The article, by R. W. Bennett, ALCO chief metallurgical engineer, and F. R. Baysinger, ALCO welding engineer, stresses new techniques made necessary by increasing service requirements and difficult materials. A welding process table, illustrating filler metals and methods used with different materials, and weld drawings and photomicrographs are included. The article's text covers design considerations, materials, procedure evaluation and training, processes, stress reduction and stress-reduction tests. If you want a copy of the *Alco Products Review* containing this article, write the *Engineers' Preview* Editor.

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PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

PLANS FOR a two-week Special Summer Program on Behavior of Materials at Elevated Temperatures to be given at the Massachusetts Institute of Technology from July 11 through July 22, 1955, have been announced by Professor Ernest H. Huntress, Director of the M.I.T. Summer Session.

Jet engines, gas turbines, nuclear power reactors, and many other applications are placing severe demands on materials for service at high stresses and high temperatures. This program is planned to provide an opportunity to assess current research and material developments and applications in this field. Dr. Nicholas J. Grant, Associate Professor of Metallurgy at M.I.T., will direct the program.

• • •

EFFECTIVE June 1, 1955, D. F. Steinke, Director of Power Education, The Dow Chemical Co., Midland, Mich. accepted a new position to become Overseas Coordinator of Training for Standard-Vacuum Oil Co. He will be affiliated with N. V. Standard-Vacuum Petroleum Maatschappij and will ultimately be located at Sungei Gerong, Palembang, Sumatra, Indonesia.

• • •

EFFECTIVE JANUARY 1, 1955, Paul Rogers' association with his former partner, Howard J. Snitoff, has been dissolved, and Mr. Rogers will continue his consulting engineering office under the name of Paul Rogers and Associates at 510 No. Dearborn St., Chicago 10, Ill., specializing in structural design of sewage and water treatment plants, bridges, power stations, multi-story buildings.

• • •

CHARLES E. MORROW, head of the power and service facilities mechanical engineering department, Hawthorne Works, Western Electric Company, Chicago, has been promoted to the rank of assistant superintendent of construction, effective May 1, reporting to Superintendent C. H. Fickinger of 220 Church Street, New York.

Morrow earned a B.S. degree in mechanical engineering in 1924 from the University of Illinois and in 1954, the professional master of engineering degree.

IN THE OFFICE of National Safety Council in Chicago, General George C. Stewart, general manager of the council (center) presents to Andrew W. Kramer, editor of POWER ENGINEERING (right) an attractive plaque symbolizing NCS's 1954 public interest award to POWER ENGINEERING "for exceptional service to safety" in the form of its continuous program of safety articles. At left, Chester R. Earle, executive editor of POWER ENGINEERING, watches presentation. This is the award noted on page 4, June issue. Bibliography of the safety articles sent on request.

He began his Western Electric career in 1927, as a mechanical engineer, and worked at Hawthorne until 1929, when he accepted the position of chief engineer of Ohio State University. In 1937, he returned to Hawthorne as a mechanical engineer. He became a service system engineer in 1944 for both the Hawthorne and the St. Paul plants. Since then he has been chief power plant engineer, power and service facilities engineer, and factory planning engineer.

In his new position, Morrow will be stationed in the distributing house at Syracuse, New York.

His articles on technical subjects have been published in POWER ENGINEERING and other technical magazines and he is a frequent speaker before technical groups. He is a member of ASME.

• • •

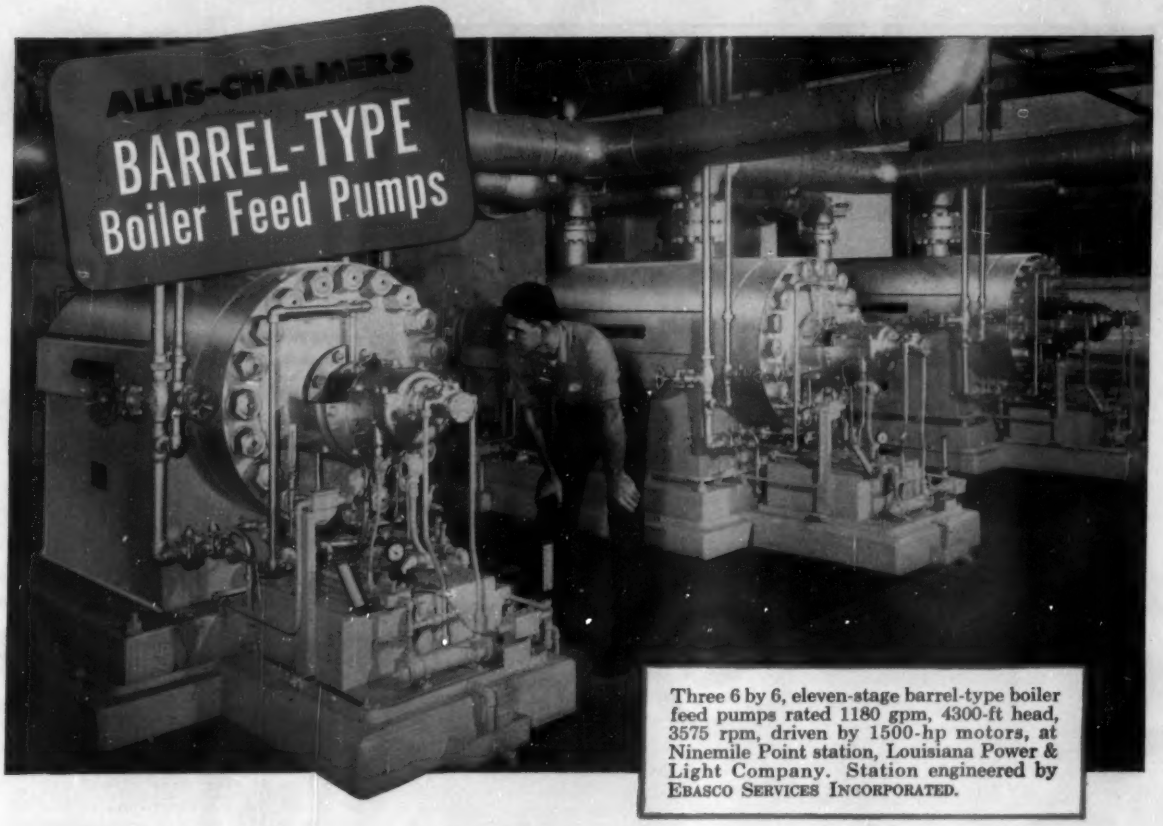
OWEN S. LIEBERG, member, American Society of Heating and Air Conditioning Engineers, professional engineer, is now associated with Cosentini Associates, 237 First Avenue, New York 3, N. Y., in their general consulting practice of mechanical and electrical engineering. Mr. Lieberg will continue to specialize in the design of high-temperature water installations and radiant cooling and heating systems.

• • •

STONE & WEBSTER Engineering Corp. has announced that Russell T. Branch and T. Cortlandt Williams have been elected chairman of the board and president, respectively, of the Corporation.

Mr. Branch, who has been president of the Engineering Corporation and responsible for its activities since 1945, has also served the organization continuously and in various capacities, including construction manager and executive vice president, since his graduation from Stevens Institute of Technology in 1912.

Mr. Williams, who obtained his engineering degree from Bucknell University in 1920, has been identified with Stone & Webster since 1923 and has likewise had broad experience in the engineering and construction field. He was appointed construction manager in 1942 and elected executive vice president of the Corporation in October 1953.



Three 6 by 6, eleven-stage barrel-type boiler feed pumps rated 1180 gpm, 4300-ft head, 3575 rpm, driven by 1500-hp motors, at Ninemile Point station, Louisiana Power & Light Company. Station engineered by EBASCO SERVICES INCORPORATED.

First Choice with Louisiana Power & Light Company

A proved service record the country over . . . simple, low maintenance design . . . high efficiency performance — these were some of the factors that led Louisiana Power & Light Company to choose Allis-Chalmers barrel-type boiler feed pumps for their Ninemile Point station.

Features Keep Operating Costs Low

First stage has twin, single-suction impellers to give low NPSH requirement for highest efficiency under fluctuating loads. Impellers, mounted back to back, balance axial forces without use of balancing drum. Double volute casing maintains radial balance under fluctuating load. Expansion joint and shaft seals are brought to outside of pump where they may be inspected often and worked on easily, if required.

Complete Unit From One Source

Allis-Chalmers can supply the complete pumping unit — pump, motor and control — of coordinated design and manufacture. You get one responsibility — one guarantee of satisfaction.

Get complete information on Allis-Chalmers barrel-type boiler feed pumps. Call your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B7899.

A-4635

ALLIS-CHALMERS A-C ALLIS-CHALMERS

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HERE'S WHAT THEY TELL US

OLIVER A. NELSON, American Peoples Encyclopedia, who wrote to our editor, said

> We are undertaking a complete revision of the American Peoples Encyclopedia, and would greatly appreciate it if you could review the important entry on Boilers for us and perform whatever revision and updating are necessary. Also I would appreciate your doing the same for two small entries that are closely related — Boiler Compounds and Boiler Construction Code.

Editor Kramer has rewritten the section on Boilers and the one on Boiler Compounds. The item on Boiler Construction Code needed practically no revision because there has been no fundamental change in the code nor its basic purpose.

FROM PUERTO RICO, W. C. Tatman wrote

> The extra February issue of POWER ENGINEERING and the tear sheets received okay. Many thanks. The extra copy has been placed on file in our public information office in the base historical records. The Public Information Officer was quite impressed with the magazine and the way you dressed up the article on the Ramey Plant.

If you missed Mr. Tatman's interesting article, Foolproof Diesel Plant Serves Ramey Air Force Base, see the February '55 issue pages 96–97.

L. RENE DUVAL, Republica Dominicana, commented

> As an operating engineer with sixty years of experience in the field and who started in, with no formal higher schooling, from the coal scoop and slice bar, through the locomotive and steamship fields and power plant work, both in erection and operation, first as a subordinate and later as chief for ten years of a utility plant and now another ten years in a factory power plant, I wish to tell you that I consider the article in July '54 issue of POWER ENGINEERING, entitled "Power Plant Grasp," simply SPLENDID.
>
> I made up for my lack of educational training by a continuous search for the *why* of things in every line of work in which I was employed, and not only in my actual field but in related fields. And often something learned in a related field served to clarify a difficulty in my actual field of work.
>
> Since being a chief I have tried consistently to inculcate this spirit in my subordinates, but often, I regret to say, with rather disheartening results.
>
> We are, as Mr. Browning says, a peculiar sort of men.

A POWER ENGINEER who supervises nearly a hundred men requested ten enlargements of all the photographs appearing in Associate Editor Jones' series, So — You're Going to Overhaul Your Turbine Generator. He said

> Our men are not as familiar with turbine construction and overhaul as they should be, so the pictures would be very useful in helping to instruct them.

This series of articles began in the April 1955 issue and will appear in a total of approximately ten issues of POWER ENGINEERING. *We plan to make reprints of the series.*

OUR ANDREW KRAMER is one of a number of editors and newspaper representatives invited to an "Open House" at the Los Alamos Scientific Laboratory, July 16 and 17. This will be the first time that members of the press will have an opportunity to inspect this famous laboratory.

Los Alamos Laboratory, which is Operated for the U. S. Atomic Energy Commission by the University of California, is the birthplace of the atomic bomb. It was here that the first atomic bomb was assembled, and this occasion marks the tenth anniversary of the detonation of the world's first atomic bomb near Alamogordo, N. M.

This will be an entirely informal meeting and the guests will be shown many of the new facilities and installations in the Laboratory's recently expanded 77 sq mi technical area.

All tours and discussions will be completely unclassified.

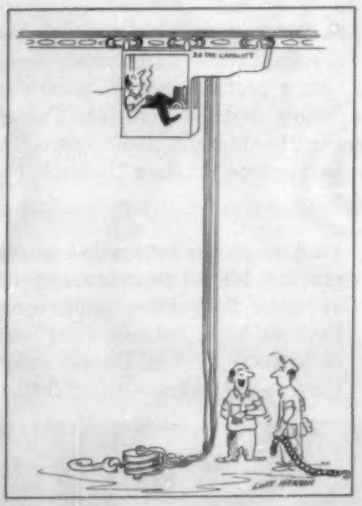
TO ONE FRIEND abroad, Editor Kramer wrote

> I presume that by this time you will have obtained some of the details of the new plant to be built near New York City by the Consolidated Edison Co. May '55 issue, page 91. This, of course, will be the first complete, privately-owned plant to be built in the United States. The other plants now in process of design or construction are all AEC plants.
>
> This plant will be the third pressurized-water type of plant to be built. The first was the plant in the *Nautilus;* the second is the plant to be built at Shippingport near Pittsburgh by the Duquesne Light Company.
>
> It seems to me that there is a very great lack of imagination or enterprise in regard to these plants on this side of the Atlantic. There must be at least twenty different types of reactors that should be tried out, and private industry should not let the Atomic Energy Commission do all the research. They should be willing to put some of their own money into the development of some of these new reactor types.

Included in the answer to Kramer from England, the writer commented

> Your statement that there seems to be a lack of imagination over there on the part of private enterprise also holds good for this country. There are a few firms here that have formed special companies to provide the supplies of new equipment, but all on the basis of firm orders from the British Atomic Energy Commission.
>
> Believe me, the private industry over here is even more careful and hesitant than their American counterparts.

Steel magazine just recently sent our editor two items concerning plans of World Steel Corporation to build an atomic power plant for the operation of its mill. To the best of our knowledge, this is the first time an industrial company has been interested in actually building an atomic power plant.



"It's his way of saying — coffee time."

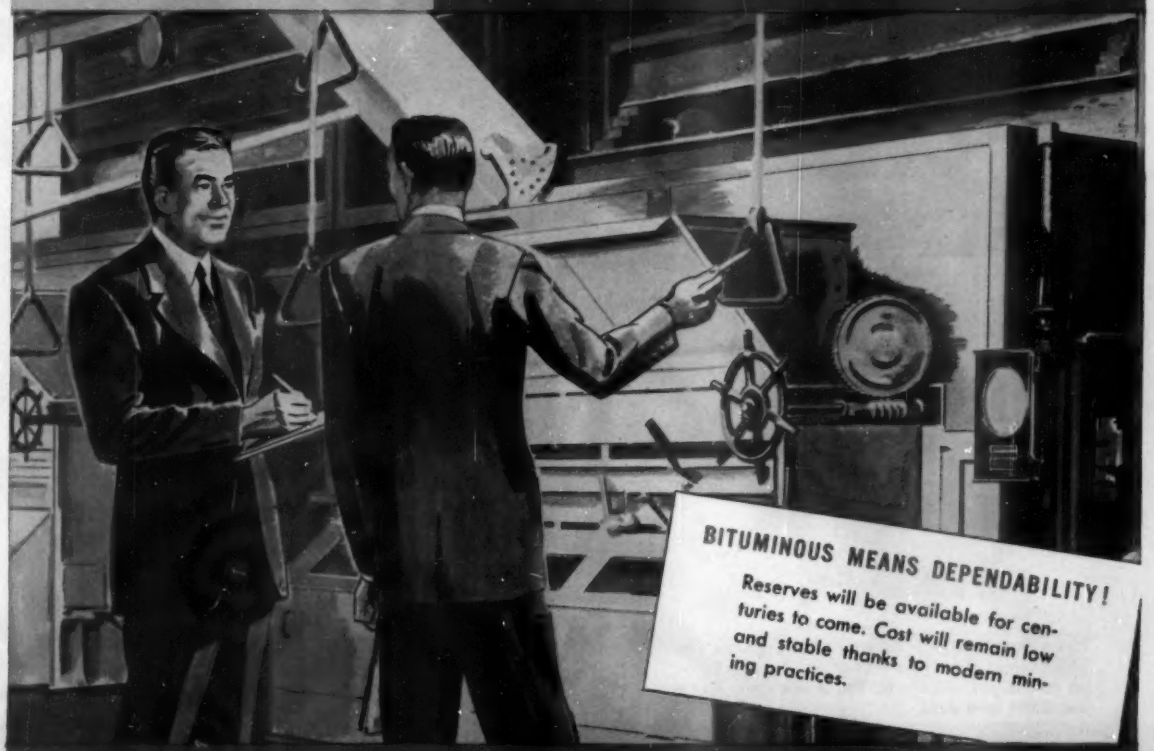
Are you now using the most efficient coal for your purpose?

LET OUR TECHNICAL SERVICE ADVISE YOU!

No two plants are alike—design and equipment characteristics make the difference. That's why it's so important to consider *kind* and *size* when selecting a coal for your particular burning equipment. The B&O Technical Service is prepared to study your specific problem and help you choose the correct coal. Here's what our service does for you:

- outlines Bituminous coals available for your plant.
- discusses the merits of these coals.
- establishes current and predicts future relative values of these coals.
- determines the best coal for your system.
- suggests the most efficient way to burn this coal.
- supplies case histories of actual savings in fuel costs.

Ask our man! Write:
COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND



BITUMINOUS MEANS DEPENDABILITY!

Reserves will be available for centuries to come. Cost will remain low and stable thanks to modern mining practices.

Baltimore & Ohio Railroad

Constantly doing things—better!

BITUMINOUS COALS FOR EVERY PURPOSE

For more data circle 504 on Post Card

it's **boiler check-up** time!

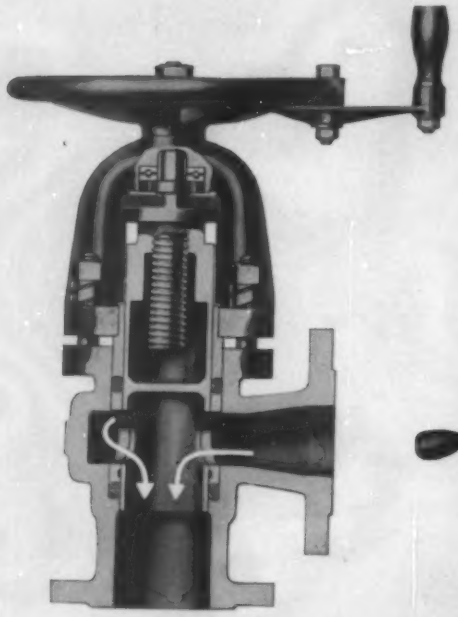
HOW ARE YOUR BLOW-OFF VALVES?

Are they drop-tight? Rugged and dependable? Easy to maintain?

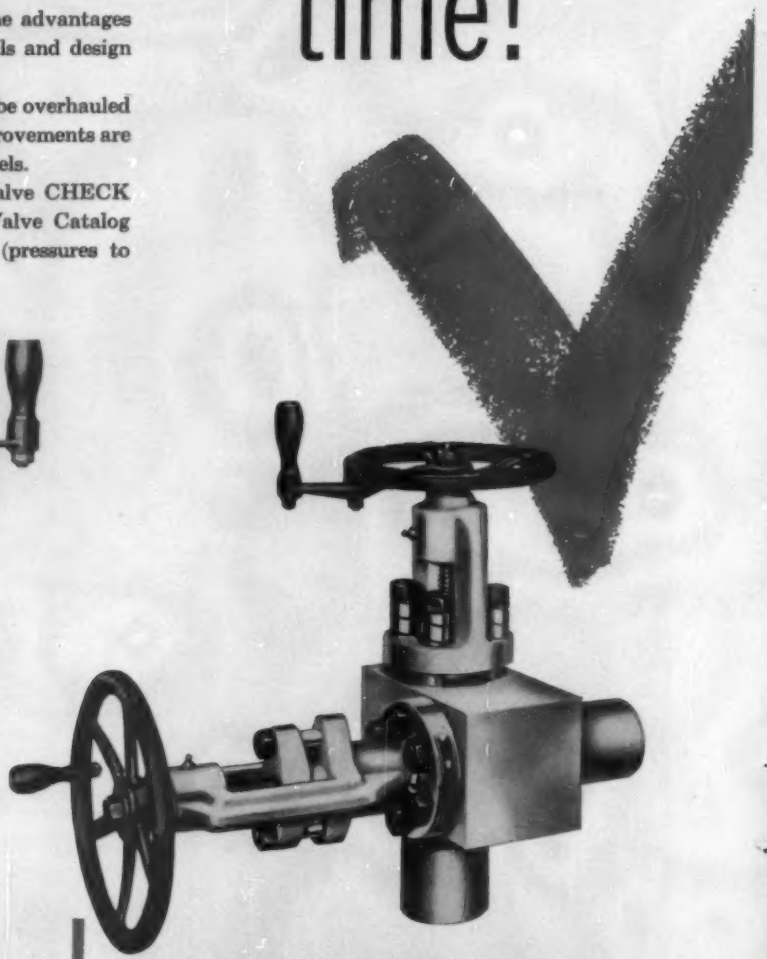
Just as important, do they have all the advantages and up-to-date improvements in materials and design of new YARWAY Blow-Off Valves?

Old YARWAY Blow-Off Valves also can be overhauled and modernized, because all YARWAY improvements are *interchangeable* with parts on earlier models.

Write today for YARWAY Blow-Off Valve CHECK SHEET—also new YARWAY Blow-Off Valve Catalog B-426 (pressures to 400 psi) or B-434 (pressures to 2500 psi).



Yarway Seatless valve for low and medium pressures. Features balanced nitralloy plunger that seals line drop tight—yet permits free, unobstructed flow in blow-down. **Used in over 15,000 boiler plants.**



Yarway Unit Tandem Blow-Off Valve for higher pressures. Combines Yarway Seatless Valve and Yarway Hard-Seat Valve, or two Yarway Hard Seat Valves, in a one-piece forged steel body. For years—the choice of 4 out of 5 high pressure power plants.

YARWAY steam

✓ WHAT ABOUT WATER COLUMNS AND GAGES?

Are they in good working order? Are they up-to-date?

Is the water level clearly visible from the operating floor? YARWAY Gages equipped with Type "M" Illuminators make the meniscus "shine like a star"—even under adverse conditions.

Now's the time to install modern YARWAY Water Columns and Gages. Twelve distinct improvements in YARWAY Gages have increased gage life—decreased gage maintenance. Write for latest Catalog WG-1812.

✓ HOW ABOUT ADDING NEW REMOTE LEVEL INDICATORS?

Remote readings of boiler water level at any spot in the plant are a recognized convenience—and easy with new "Wide Vision" YARWAY Remote Liquid Level Indicators.

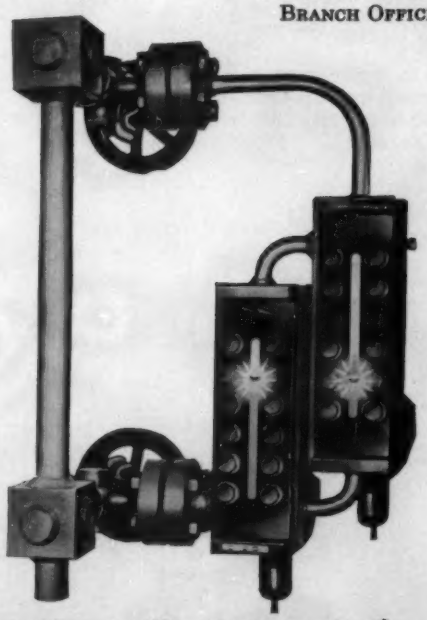
Because the indicating mechanism is operated by the boiler water itself, response is always instant, readings always accurate.

YARWAY Hi-Lo Graph Recorder not only gives remote indication but also a 24-hour recording of water levels.

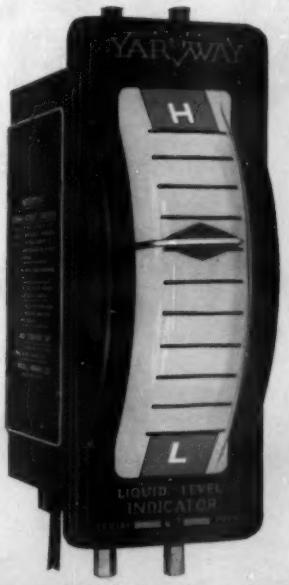
YARWAY Remote Indicators and Recorders can also be supplemented with Remote Hi-Lo Alarm Signals—light or horn.

Write for Catalog WG-1823.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



Yarway high pressure Flat-Glass Water Gage assembly with tie-bar type circulating water column. Note separated design, expansion loops, flanged connections and Type "M" illuminators. Other columns and gages for lower pressures.



Yarway Remote Liquid Level Indicator with new "wide vision" face. Manometric type with automatic temperature compensation where required. Over 10,000 used throughout industry.

plant equipment

For more data circle 505 on Post Card

How exhaust heat from a G-E Gas Turbine can cut your plant operating costs

NEW CYCLE CAN RESULT IN EFFICIENCY AS HIGH AS 70%

With more than 675,000 hours of successful commercial operation to their credit, General Electric gas turbines now offer power engineers this *new* formula for lowering processing costs:

Use the gas turbine to drive a generator of up to 16,000 kw or mechanical equipment up to 21,500 hp; pass the exhaust heat through a heat-recovery boiler to supply plant process steam up to 95,000 lbs. per hour. (If more process steam is required, use supplementary fuel firing to obtain up to 270,000 lbs. per hour.)

The resulting over-all efficiency may be as high as 70%!

Operating costs are low because gas turbines offer not only fuel savings resulting from high-cycle efficiency, but also economies in water, lubricating oil, maintenance, and manpower requirements. In addition, modified low-cost residual fuel oil can be burned in G-E gas turbines to provide even greater economy.

Initial costs are low too. Only small buildings and simple foundations are needed to install a G-E gas turbine; a new self-contained base houses most related auxiliary equipment.

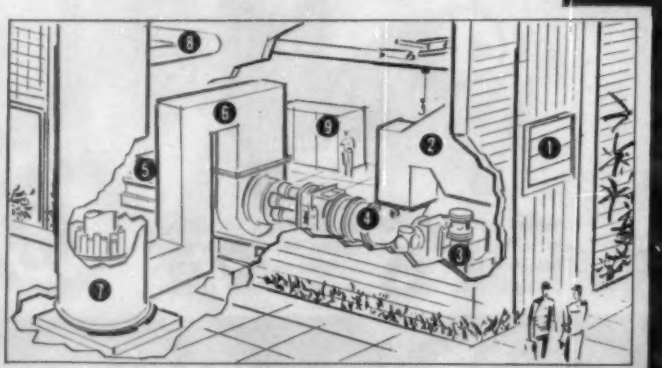
Your company may well profit from using a G-E gas turbine, and General Electric will be happy to work out an economic study with you.

For more information contact your nearest G-E Apparatus Sales Office or write for Bulletin GEA-5516B. General Electric Company, Section 261-16, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

TREMENDOUS SAVINGS in installed cost have been made possible by this new gas turbine base mounting, recently developed by G-E engineers. Serving as a rigid foundation, it also houses most of the auxiliary equipment.

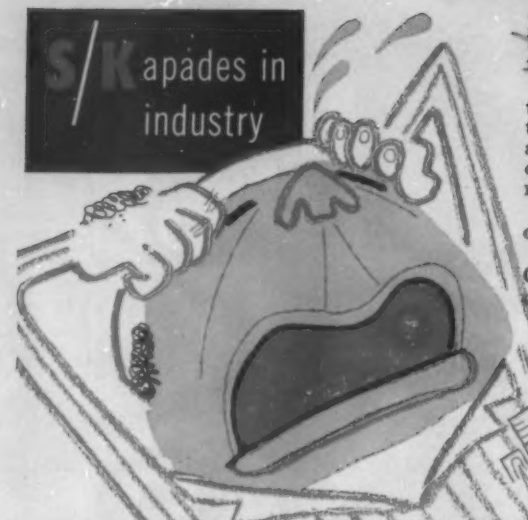


CHIEF COMPONENTS are: 1. Filter and/or air washer, 2. inlet duct, 3. starting unit device, 4. gas turbine, 5. gas compressor or driven equipment, 6. exhaust duct, 7. exhaust heat recovery boiler, 8. steam to process, 9. control unit.

For more data circle 306 on Post Card

GENERAL ELECTRIC

S/K apades in industry



Meet Melvin, the Master Mechanic, who bought crying towels by the gross. A fouled-up feedwater heater system had him flipping his wig.

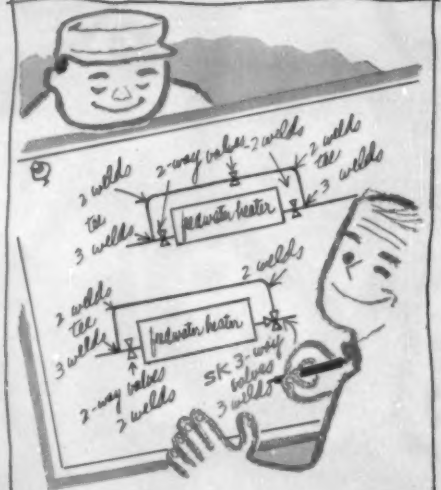
Trouble was, the system had to be replaced and Melvin was the man assigned to do it—economically. Just thinking about the cost of the heater, bypass piping, three two-way valves, and installation (including sixteen high pressure, radiographic quality, welded connections), was enough to make any grown man cry.

Melvin had no more peace of mind than a nudist in a patch of poison ivy. Until . . .

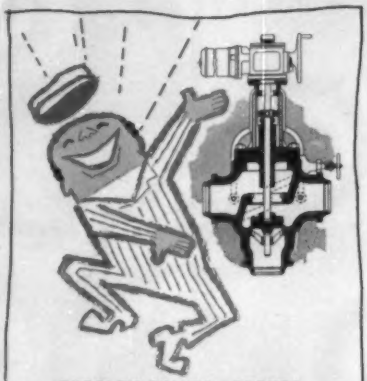
Until someone reminded him about Schutte and Koerting Company Bulletin V-1. He rushed for his copy and read it carefully.

THE CASE OF THE FOULED-UP FEEDWATER HEATER AND THE MOURNFUL MASTER MECHANIC

Bulletin V-1 showed him several ways to simplify valving and reduce maintenance. And at the same time, it suggested ways of regulating boiler feedwater through-flow, or bypass around, the feedwater heater. An SK Sales Engineer—summoned by 'phone—helped him even more.



The diagrams show how the SK Sales Engineer solved Melvin's problem. Two-way valves in the bypass line and at the inlet side of the feedwater heater were eliminated. One SK three-way valve at the heater inlet side took the place of both!



PROBLEM SOLVED—PRONTO

Installation of the SK Boiler Feedwater, Regulating and Heater Bypass (three-way) Valve cut installation costs to the bone. Elimination of the two-way valves in the bypass line and before the heaters did away with four welded connections. Piping was simplified and the possibility of human error in operating valves reduced. And the Master Mechanic—minus crying towels—is now known as Mirthful Melvin.

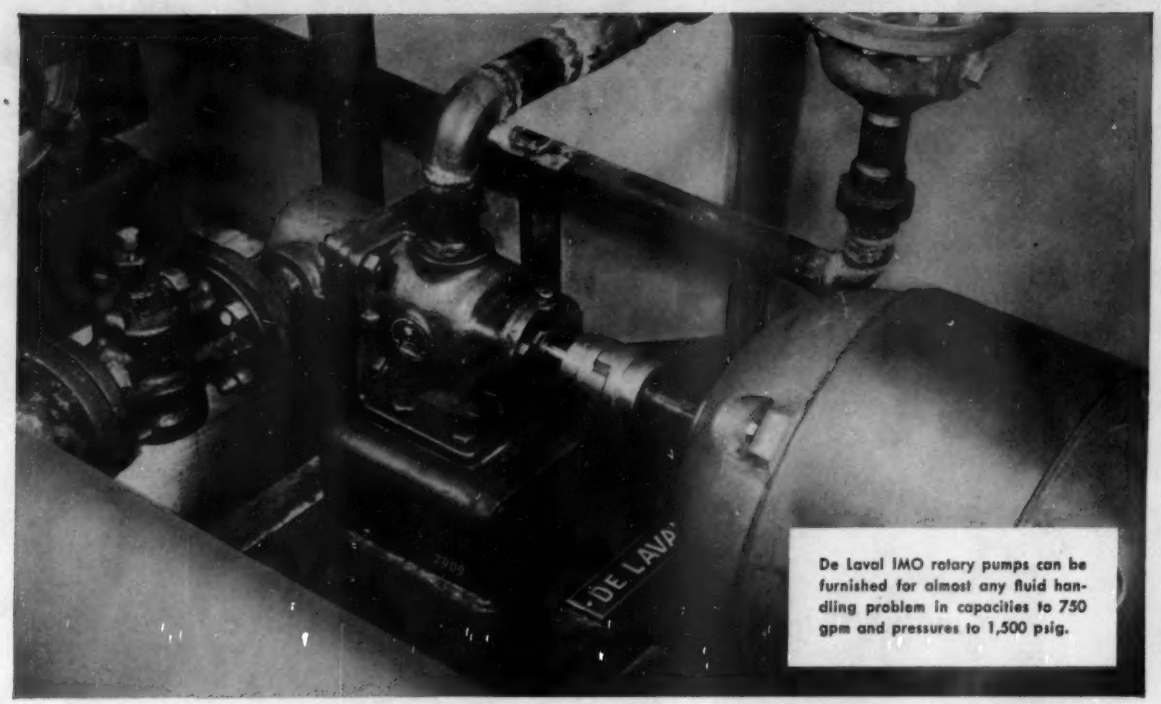
MORAL:

Send for your free copy of Bulletin V-1 now. And whenever you're ready for more details, telephone for a specialist—your nearest SK Sales Engineer. We'll be glad to send you his name and phone number.

Schutte and Koerting
COMPANY
MANUFACTURING ENGINEERS
2221 STATE ROAD, CORNWELLS HEIGHTS, BUCKS COUNTY, PA.

Jet Apparatus • Heat Transfer Equipment
Strainers • Condensers and Vacuum Pumps
Oil Burning Equipment • Rotameters
Flow Indicators • Radiafin Tubes • Valves
Spray Nozzles and Atomizers • Gear Pumps
Desuperheaters

For more data circle 507 on Post Card



De Laval IMO rotary pumps can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 1,500 psig.

What to Look for in a Rotary Screw Type Pump

By W. J. MONCON, *Assistant Chief Engineer*
De Laval Steam Turbine Company

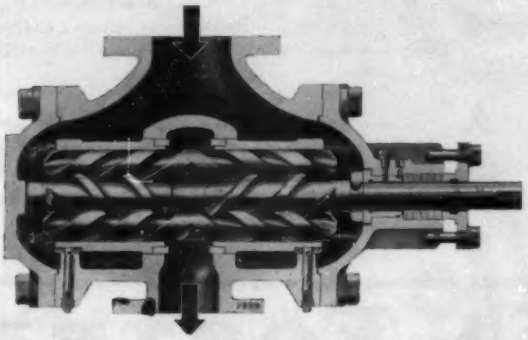
A sound knowledge of design, and how it affects performance, is the best insurance a buyer can have that he will get the pump he needs. This brief analysis of the IMO, a rotary three-screw pump manufactured by the De Laval Steam Turbine Company, will give you some of the necessary facts.

What qualities should you look for in a rotary type pump? It must, of course, meet specified capacities and pressures. But, it must also be efficient, operate quietly, stay on the job.

The axial flow of a screw type pump, and the resulting low inlet losses for any given pump speed, are important benefits that should be considered in making pump selections. The absence of timing gears and other mechanical features of construction also enable the De Laval IMO pump to operate at direct-connected motor and turbine speeds . . . to handle viscous liquids and high suction lifts.

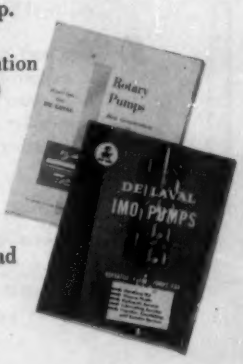
One of the most important features of the IMO pump is the hydraulic turning of the idler or sealing rotors. The central or power rotor is the pumping element; the liquid pumped turns the sealing rotors.

A screw type pump is well suited for applications where pulsation-free flow is desirable. The axial flow of the liquid without trapping and the unique thread form which keeps closures fluid-tight contribute to quiet operation of the IMO pump.



De Laval IMO Series A322A, a positive displacement, rotary screw type pump, can handle capacities to 750 gpm and pressures to 150 psig.

Catalog LS gives useful application and specification data on the IMO pump. An article titled, *Rotary Pumps, Basic Considerations in Their Application*, contains a description of rotary pumps in general. For these publications, write on your company letterhead to De Laval Steam Turbine Company, 816 Nottingham Way, Trenton 2, New Jersey. DL-301



Steam Generators of offer important savings

Advanced design features of Foster Wheeler "SC" Series Standard Steam Generators mean maximum economy of installation, operation and maintenance

FUELS: Oil or Gas

CAPACITIES: 50,000 to 150,000 lb/hr

STEAM PRESSURES: With superheat, to 1100 psi
Without superheat, to 1500 psi

STEAM TEMPERATURES: Saturated to 950 F

The "SC" Series Standard Steam Generator is the latest development by Foster Wheeler toward the reduction of steam costs for manufacturing and process plants. Pre-engineered in all details and standardized for economy, the new units are available in nine sizes with maximum inputs of 56 million to 201 million btu.

Although dimensions and structural details are fixed, the design provides a wide choice of temperatures and pressures, 48" or 54" upper drums, balanced draft or pressurized firing, type and location of heat recovery equipment, fans and drive, and make of burners for oil or gas firing.

The advanced features of this design, some of which are noted below, contribute to low installation, operating and maintenance expense and maximum dependability under continuous, full-load operation.

1. **COMPLETELY WATER COOLED FURNACE** with 3" OD closely spaced tubes minimizes setting maintenance and prevents excessive exit gas temperatures.

2. **OVER 19 FOOT FIRING DEPTH** permits long horizontal flame travel with minimum of ineffective or unused furnace volume.

3. **FULLY DRAINABLE SUPERHEATER,** available when superheat is desired, simplifies operation and eliminates a potential trouble spot.

4. **STEAM PURIFYING SYSTEM** consisting of horizontal separators, chevron driers and dry box provides steam purity of less than 1 PPM.

5. **EFFICIENT CONVECTION SURFACE** of 2" OD tubes in a staggered, cross-flow arrangement, combines maximum heat transfer with minimum draft loss. Single-pass boiler section eliminates baffles, dead gas pockets, and further reduces maintenance and draft losses.

6. **UNRESTRICTED CIRCULATION** — Absence of headers provides free circulation through integral risers and downcomers, eliminates header handhole plates and gaskets as possible sources of leakage.

7. **FULL INSULATION** together with the relatively close spacing of the furnace tubes, results in low casing temperatures.

8. **BOTTOM SUPPORTED UNIT** fully utilizes the structural strength of the steel tubes and provides for free expansion of all pressure parts within a stationary casing. This provides low unit stresses in all members and results in a rugged structure that is economical to erect and install.

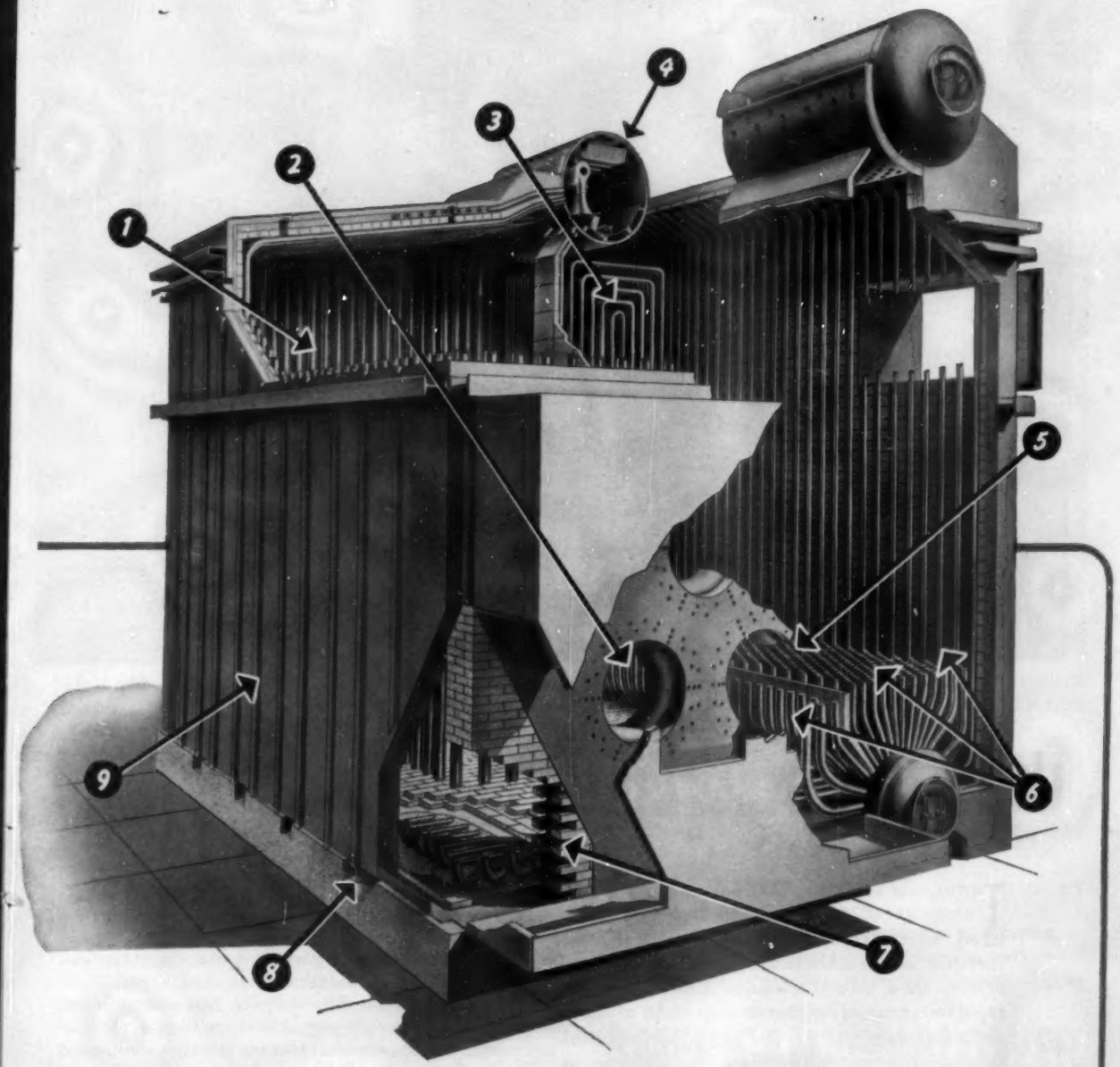
9. **ALL WELDED CASING** forms a rigid, pressure-tight unit. Possible sources of air and gas leakage are reduced to a minimum, thus providing lower operating costs through more efficient combustion.

LONDON • NEW YORK
PARIS • ST. CATHARINES, ONT.

FW FOSTER

STANDARD DESIGN

in industrial steam costs



WHEELER

FOR COMPLETE INFORMATION on the "SC" steam generators, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

Gadsby Plant, located on the outskirts of Salt Lake City, is the largest steam-electric generating station in UP & L's system.

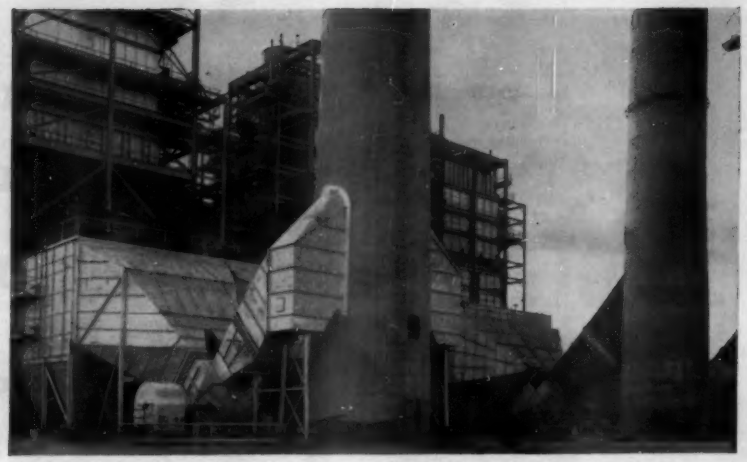
Utah Power & Light doubles capability

IN THE VAST Utah-Idaho-Wyoming-Colorado area where the Utah Power and Light Company serves some 700,000 people, raw minerals and chemicals are in abundance. Industries' influx to develop these natural resources is increasing at a rapid rate. So much so, that to keep ahead of rising electrical needs, UP & L has more than doubled its generating capability in the past 10 years to over 620,000 kw – and the end is not in sight!

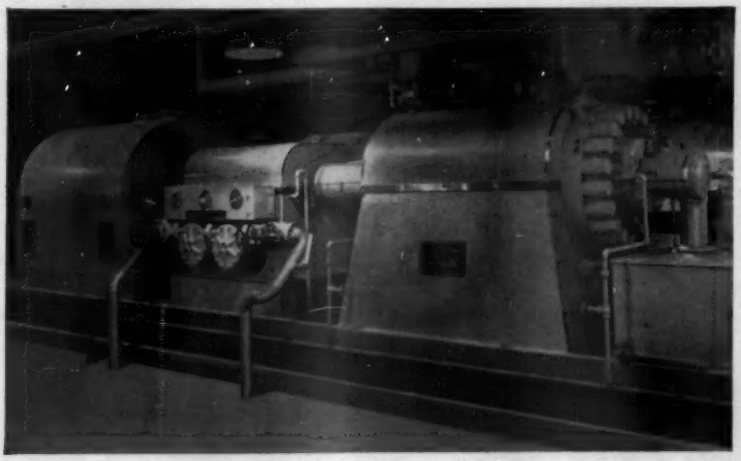
Costing upwards of $109 million, UP & L's new and improved electrical facilities include – at its Gadsby Plant – a new 100,000 kw steam-electric generating unit which utilizes the reheat cycle. As a part of this efficient operation, American Blower Sirocco Induced Draft Fans, Gyrol Fluid Drives, and Gas Recirculating Fan were selected.

The important part American Blower plays in UP & L's expansion program is being duplicated in dozens of other progressive, investor-owned companies. Utility men across the nation depend on American Blower Mechanical Draft Fans, Fly

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS &



Completed in June 1955, UP&L's new 100,000 kw No. 3 unit (left) boosts Gadsby Plant capability to 241,000 kw. The unit's two American Blower Sirocco Induced Draft Fans are each rated @ 260,000 cfm @ 325° F @ 15.5" sp @ 860 bhp. American Blower equipment is also installed on units No. 1 and No. 2.



American Blower Type VS, Class 6 Gýrol Fluid Drives provide adjustable speed control of boiler feed pumps at Gadsby Plant. Rating is 2500 hp @ 3600 rpm.

with the help of American Blower

Ash Precipitators, Dust Collectors, Heavy-Duty Steam Coils, and Gýrol Fluid Drives for boiler feed pump and fan control. And so can *you!*

For whether your modernization or expansion calls for indoor or outdoor installations, American Blower makes *your* problems *their* problems — and supplies air-handling equipment to meet your exact needs . . . to deliver peak performance continuously. To talk over your plans with an experienced representative, give your American Blower Branch Office a call.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

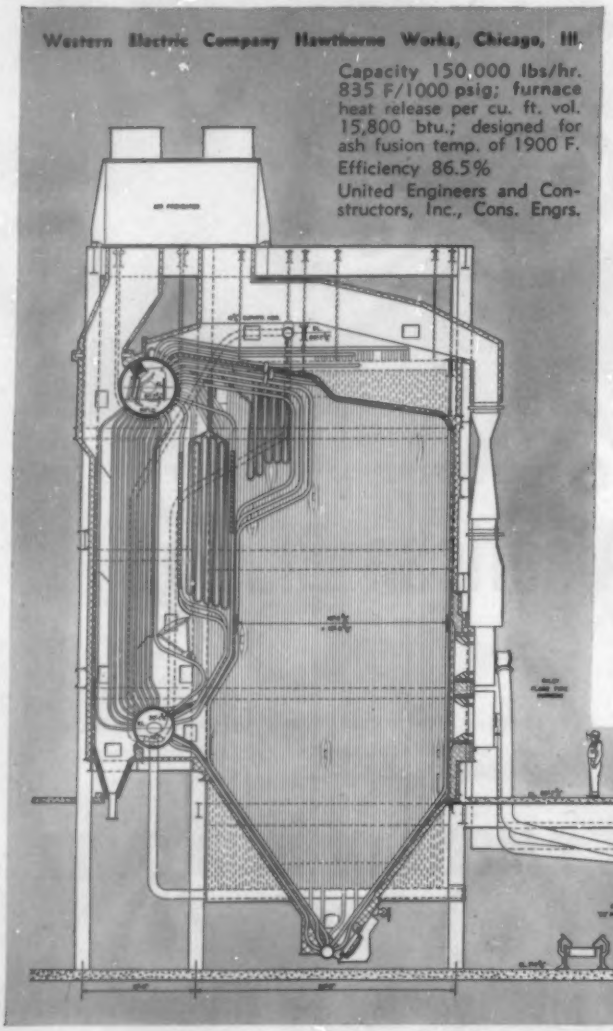
For more data circle 510 on Post Card

NOW . . . 26 million pounds of steam/hr. generated by RILEY units with the

*SINGLE HEADER HOPPER BOTTOM

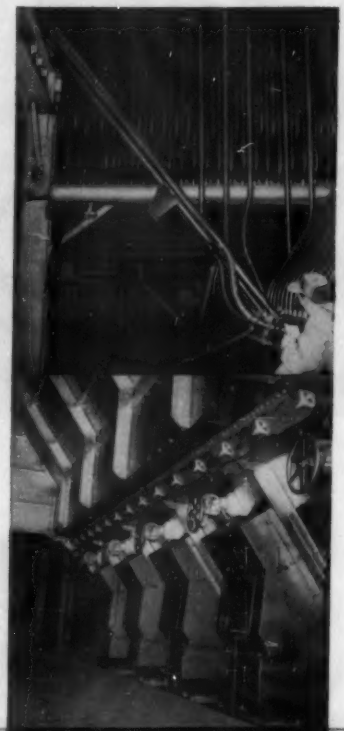
. . . a design recommended by scores of power plant engineers and consulting engineers for its satisfactory operation and money-saving features.

*Patented



Western Electric Company Hawthorne Works, Chicago, Ill.

Capacity 150,000 lbs/hr. 835 F/1000 psig; furnace heat release per cu. ft. vol. 15,800 btu.; designed for ash fusion temp. of 1900 F. Efficiency 86.5%
United Engineers and Constructors, Inc., Cons. Engrs.

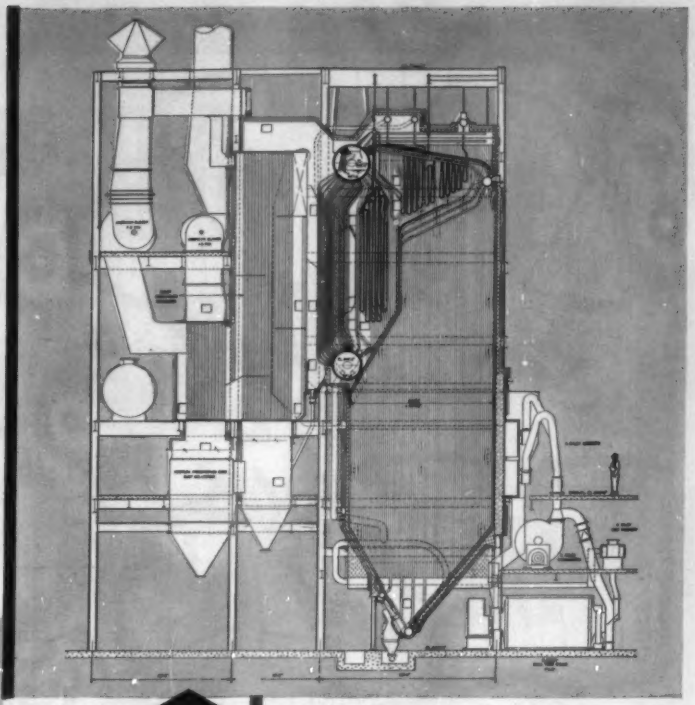


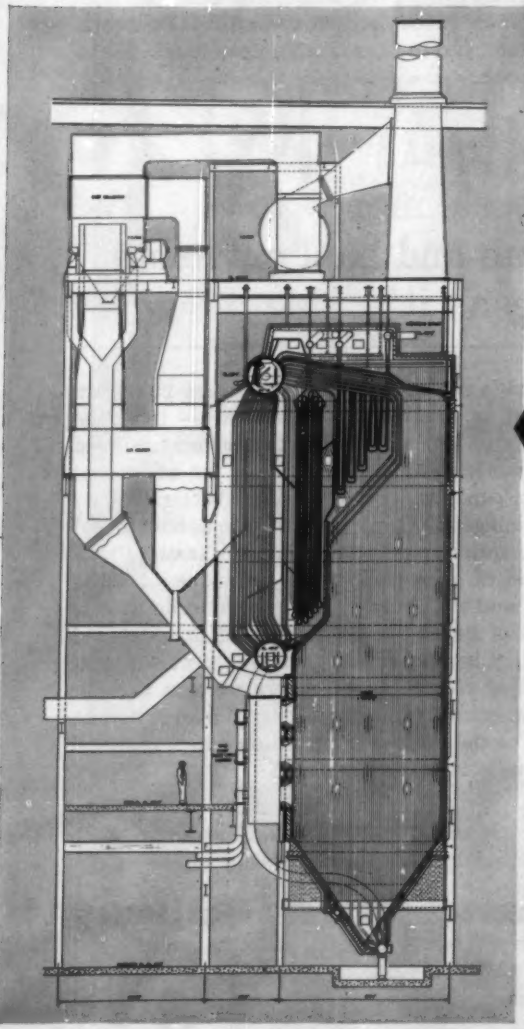
Partial tube assembly of Single Header Hopper Bottom. Offset tubes at header provide openings for ashes to pass into ash removal system. Lower sidewall header is shown.

Typical ash removal system for Riley Single Header Hopper Bottom showing gate controls, access doors, and pipe for hydraulic system.

Your nearest Riley Representative will gladly furnish you with further details about Riley Single Header Hopper Bottom installations, or write to Riley Stoker Corporation, Dept. A, Worcester, Massachusetts.

- Successful with all types of high ash coals, even with ash fusion temperatures as low as 1900 F. No ash removal difficulties.
- Ideal for units firing a combination of coal, oil and/or natural gas, or, where coal may be used in the future.
- Integrated design eliminates the cost of separate hopper, and seals between unit and hopper with their maintenance.
- A convenient pneumatic or hydraulic ash removal system may be added.
- Reduces over-all building height . . . permits higher capacity unit in existing building.
- Adaptable to units of any capacity.





Dairyland Power Cooperative
Cassville, Wisconsin
Capacity 230,000 lbs/hr; 900 F/1000 psig; furnace heat release per cu. ft. vol.-19,300; designed for ash fusion temp. — 1980 F. Efficiency 86.0%
Vern E. Alden Co., Consulting Engineers.

South Carolina Public Service Authority
Moncks Corner, S. C.
Capacity 450,000 lbs/hr.; 900 F/925 psig; furnace heat release per cu. ft. vol.-17,000; designed for ash fusion temp. — 2150 F. Efficiency 87.7%
Ford, Bacon & Davis, Consulting Engineers.

A few users of over 150 units sold

Otter Tail Power Co.	Allis-Chalmers Manufacturing Co.
Central Ohio Light & Power Company	Ohio Oil Company
Bird & Son, Inc.	Goodyear Tire & Rubber Company
So. Nevada Power Co.	Hooker Electro-chemical Co.
Upper Peninsula Generating Company	North American Aviation
Western Colorado Power Co.	United Aircraft Company
City of Rochester, Minnesota	Celanese Corporation
Central Electric Power Corporation, Linn, Mo.	United States Steel
Waldorf Paper Products, Inc.	Syracuse University
Esso Standard Oil Co.	U. S. Rubber Co.
General Electric Co.	White Pine Copper Co.
	City of Holyoke, Mass.

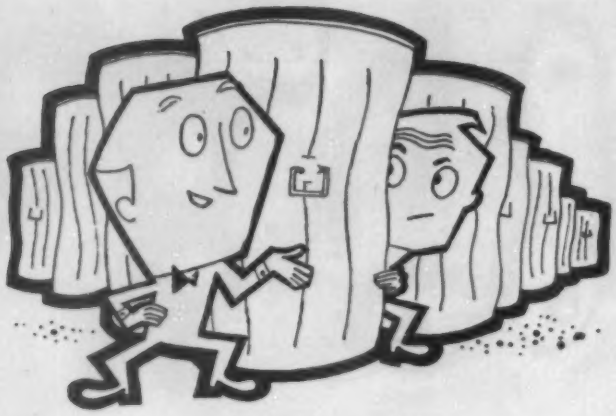
A few prominent consulting engineers
Sargent & Lundy • Ebasco Services • Chas. T. Main • Day & Zimmerman • Rust Engineering Co. • Albert Kahn • Vern E. Alden • Gilbert Associates, Inc. • Sanderson & Porter • The Kuljian Co. • Ford, Bacon & Davis • Jackson & Moreland • Burns & McDonnell • Lockwood Greene • Stone & Webster • H. M. Wilson Co.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

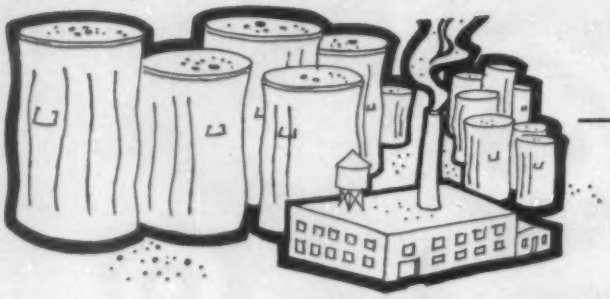
Boston, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Tulsa, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

For more data circle 511 on Post Card



What is in all the ash cans?

Ashes, of course.



Isn't that a lot of ashes for a small plant?

Certainly it is, but somebody found a "bargain" coal. It cost less per million BTU's and he never stopped to figure it contained four times as much ash.

It costs money to clean and haul out ashes, doesn't it?

That's not all. Think what we are paying in freight to haul tons of useless ashes from the mine. And all those ashes in the fuelbed cut down boiler efficiency. We don't have the additional steam capacity we had with the better coal.

Intelligent selection of the most economical coal requires careful consideration. It isn't just a matter of price. You should figure the job to be done and the equipment you have to do it. The superior quality coal produced at mines served by the Chesapeake and Ohio will meet our most exacting requirements. Before we sign another coal contract, let's get a C&O coal man in here to give us the facts and figures on which coal will cost us least in the long run.

P.S.

There's a lot more to buying coal than the cost per ton. For facts and figures to solve your particular fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

For more data circle 512 on Post Card

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL VALVES FOR POWER PLANTS

FIG. 375—Bronze Gate Valve For 200 Pounds W.S.P

FIG. 1793—Iron Body Bronze Mounted Gate Valve For 125 Pounds W.P.

FIG. 19003—900-Pound Pressure Seal Gate Valve

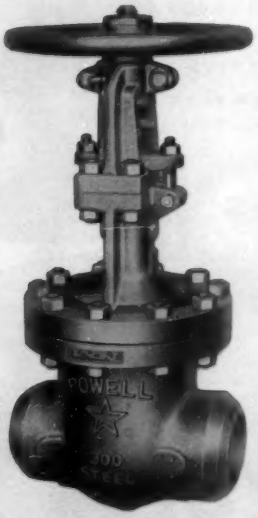


FIG. 3003—Steel Gate Valve For 300 Pounds W.S.P.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

Just name the valve you need for your power plant—Powell can supply it. And you can be certain that every Powell Valve will give you *dependable* flow control.

Shown above are just a few Powell Valves for power plants. Investigate the *complete* line of quality valves that have a proven record of long life and dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write . . .

The Wm. Powell Company, Cincinnati 22, Ohio..... 109TH year

For more data circle 513 on Post Card

They cut steam costs 20% with a—

C-E Vertical Unit Boiler Type VU-10, fired with a C-E Spreader Stoker.

The VU-10 installation at Finch, Pruyn & Co. Inc.

Plant of Finch, Pruyn & Co. Inc., Glens Falls, N. Y., a leading producer of magazine paper stock.

— C-E VERTICAL UNIT BOILER

When more steam was needed at the Glens Falls, N. Y. plant of Finch Pruyn and Co., Inc., they bought a C-E Vertical Unit Boiler, Type VU-10, fired with a C-E Spreader Stoker.

For over a year the VU-10 has been operating continuously on a six-day, three-shift basis. And during that time boiler performance has consistently exceeded guarantees and the plant's steam cost has decreased 20%.

What does Finch Pruyn think of its new VU-10? Here are some comments made by N. G. McLean, Chief Engineer, and L. J. Dolhof, Utility Engineer:

Delivery: "The delivery and installation of the new boiler established a record for speed . . . "

Operation: " . . . a clean operating boiler that affords us a steady source of steam."
" . . . this has been a very satisfactory job and doing business with you has been a pleasure."

Cooperation: "The Combustion Engineering organization cooperated splendidly with us in getting the new boiler on the line."

Such things as simplicity of operation, efficient performance, ease of maintenance and reliability are the four big reasons that account for the comments above — and for the many others like them that we have received.

So, if your steam requirements are between 10,000 and 60,000 pounds per hour, investigate the C-E Vertical Unit Boiler, Type VU-10.

Available for pressures to 475 psi, this unit can be equipped with a superheater (up to 200° F) and whatever heat recovery equipment is desired. Designs are available for coal, oil or gas firing. B-840

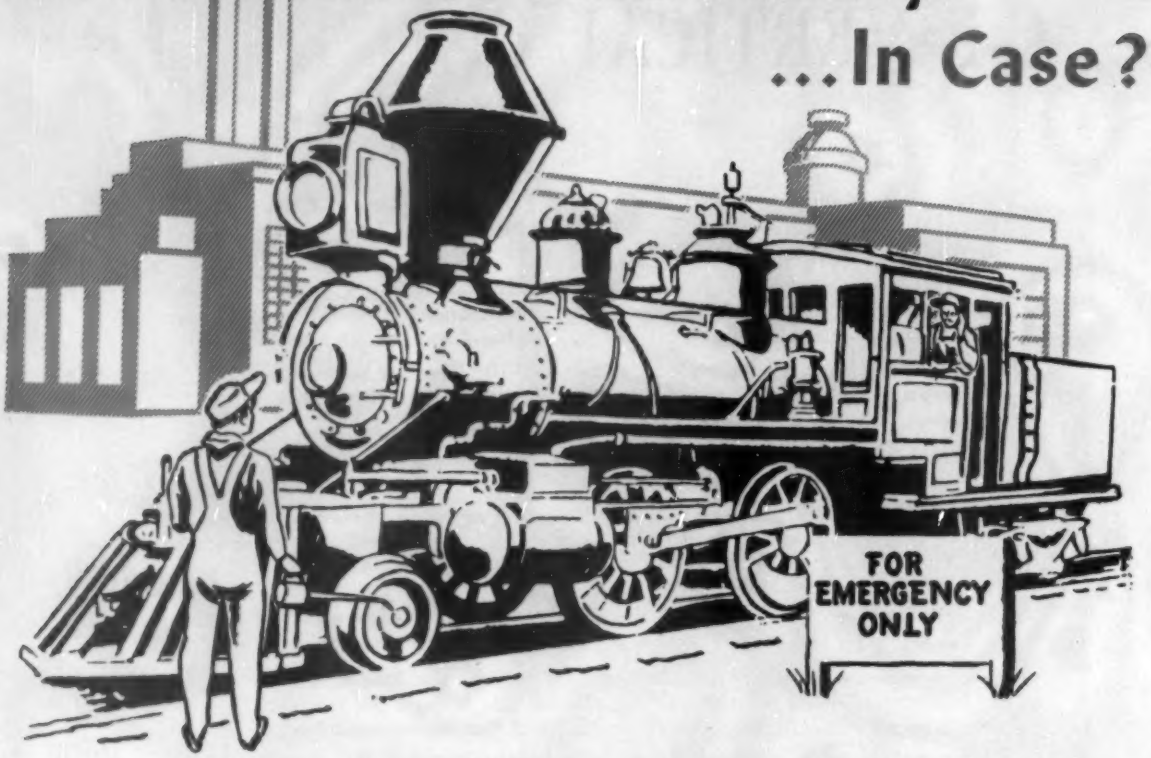
COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS AND FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

For more data circle 514 on Post Card

Got a Locomotive Handy ...In Case?



EVERY so often a steam locomotive makes news by going to the rescue of a plant where the steam system gave out at a critical time.

This is one answer to continued steam production pending repairs . . . and undoubtedly an expensive one. Simplest—and most economical—is to use the Nalco System and eliminate the chances of boiler down time due to faulty water treatment.

Nalco chemicals and services aim at *water treatment results* from raw water intake to condensate hot well . . . And the thousands of plants now using the Nalco System testify to the accuracy of this aim during the past twenty-six years. Whether your plant is large or small; your water problems scale, corrosion, carry-over—or just plain high cost—unless you have a locomotive handy for emergencies, better check with Nalco today. No obligation . . . and an excellent chance for permanent water treatment security.

P. S. More steam locomotives use Nalco-treated water than any other kind . . . Perhaps the reason why locomotives *can* be of help in plant emergencies!

NATIONAL ALUMINATE CORPORATION
6224 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to
Alchem Limited, Burlington, Ontario, Canada

THE Nalco® SYSTEM . . . Serving Industry through Practical Applied Science

For more data circle 515 on Post Card

HELPFUL BULLETINS

ELECTRICAL

101 On Circuit Breakers — The 60-pp Speedfax Catalog is designed to provide essential information on selection and application of molded case and large air circuit breakers. Application sections make extensive use of charts and tables to explain proper selection of circuit breakers for motor circuits, bus duct, conductors, and transformer secondary applications. Illustrated descriptive sections explain advantages. Also included are circuit breaker prices, dimensions, and ordering instructions. I-T-E Circuit Breaker Co.

102 Dripproof Motor — This 12-pp booklet, Form F-1856, illustrates various features of company's Type H Uniclosed motor. Cut-open views, illustrating constructional features, are shown in full color. A series of drawings with call-outs shows how Ventrifoil at both air intakes of the motor protects the interior. U. S. Electrical Motors Inc.

103 Power Capacitors — Sixteen-pp Booklet B-6136 features capacitors for utility systems. Designed to aid in selection, booklet matches various capacitor applications on transmission and distribution systems to the capacitor suited for the job. Discusses such types as: stack-type for high voltage applications; metal-enclosed units for indoor and outdoor use; low-voltage units for secondary network vaults; automatically-switched types for primary distribution circuits; pole-mounted types, others. Westinghouse Electric Corp.

104 Electrical Conduit — Eight-pp, Form 646 describes company's heavy-duty, rigid steel electrical conduit, reproducing test data sheets to show how the protected conduit stands up under corrosive attacks of salt spray, sulfuric acid, caustic soda, and exposure to excessive heat as compared with other conduit. Four-color photos illustrate effects on both after exposure to attacks listed above. National Electric Products Corp.

105 Heavy Duty Contactor — Eight-pp Bulletin 14B8171A features company's heavy duty contactors, including units and control relays for steel mill and similar heavy duty applications. Describes various models, available in ratings of from 25 to 100 amp, 600-v maximum, in single and double pole units with either normally open or normally closed contacts and mechanical interlocks. A chart illustrates parts interchangeability. Allis-Chalmers Mfg. Co.

106 Plugs and Receptacles— Twelve-pp Bulletin B59 illustrates and describes electrical plugs and receptacles for industrial power connecting requirements. Presents brief but pertinent details on electrical connectors for standard as well as special needs. Standard styles covered include round push-lock, round push-pull, round push-latch, oval push-pull, and round SPB and Quik-Loc for heavier currents. Joy Mfg. Co.

107 Portable Cords — Three types of portable cords for rugged applications are described as to construction, advantages and applications in this 8-pp bulletin. They include company's Securityflex cord for the most rugged uses; a Neoprene-jacketed type for severe industrial uses; and a rubber-jacketed type for hard service applications. Properties and specifications are included. Anaconda Wire & Cable Co.

MECHANICAL POWER TRANSMISSION

108 V-Drive Engineering Data — V-Drive selection, using horsepower rating and improved rating techniques, can be made quickly and accurately with 96-pp Catalog 50-B. Simplified formulas for standard quarter-turn and V-flat drives are augmented by tables of drives in all belt sections which have been compiled for quick selection of drives of required ratio and speed. Also contains engineering information on other types of V-belt drives. Fort Worth Steel & Machinery Co.

109 Precision Bearings — Comprehensive Catalog 52, 140 pp, offers full information on manufacturer's line of bearings, including new Sealed Guiderol bearings. Contains engineering data for ball and roller bearings, including charts, drawings and formulas for bearing load computation. Sections of booklets are devoted to Multirol and Guiderol bearings, with photos, cutaway views and drawings of each model. Dimensional and load capacity tables are included, as are mounting details, shaft and housing fits and tolerances and drawings of typical applications. Available to qualified power engineers, please state your job title. McGill Mfg. Co., Inc.

110 Adjustable Speed Drives — Bulletin PB4700-1 describes company's packaged adjustable speed drives — covering latest developments in design and construction. Tells how these packaged, pre-wired, pre-assembled units provide flexibility of d-c motor performance from an a-c power supply, and offer simple, convenient speed adjustment without intermediate changing equipment or line shafting. Crocker-Wheeler Div., Elliot Co.

INSTRUMENTS AND CONTROLS

112 Towards Automatic Control — Bulletin S-10, 12-pp, describes the various steps involved in the application of automatic control in a particular industry. Covers design, purchasing, construction of the control system, as well as problems inherent in the transition. Describes various control systems and includes photos. Automatic Temperature Control Co.

113 Temperature Control Systems — Bulletin F 6149-2, 8-pp, discusses application of automatic control to industrial process requirements. One section is designed to help in selection of sensing elements and their correct use. Control terminology, as well as rules for the selection of a proper method of control for process characteristics is covered. Also explains basic principle of the controls ranging from two-position "on-off" to proportional position. Wheelco Instruments Div., Barber-Colman Co.

114 Thermal Controls — Descriptive information and basic technical data on this manufacturer's Thermoswitch controls are presented in 52-pp Catalog 400. Generously illustrated, this booklet explains basic principle of the controls and why they are sensitive only to heat. Selection and application suggestions are provided, also ordering instructions. Products listed include cartridge, hex-head, block head, flange head, all-purpose, junction box, high temperature and other types of controls. Modifications and special features also covered. Fenwal Inc.

115 Pneumatic Flow Meters — Bulletin 285-G2A covers pneumatic flow meters for water and sewage plants. Contains photos and diagrams of typical installations together with descriptions, data on advantages, and operation of transmitters, large dial gages, summation units, and controlled automatic proportional pacing. Builders Providence, Inc.

New and revised publications reviewed on these pages offer help on operating and maintenance problems. To order, use the Reader Service Cards on page 97.

116 Thermostat Controls — Thermostat Engineering Data Book describes company's "Temp-Guard" midget type thermostats for numerous applications where reliable heat control is a must. Illustrates and explains reliability of the thermostats, and includes specifications. The Franklin Dales Co.

117 Electronic Control System — Bulletin Al. 3-1 is a condensed catalog of components of company's Autronic control system — an all-electronic control system for process and power instrumentation. Punched for insertion in standard binders, catalog illustrates and gives a brief description of the function and working principles of units. The Swartwout Co.

118 D-C Amplifier — Twelve-pp Bulletin MSP 111.1 provides pictorial diagrams and descriptive information on company's PowrAmp Model P, an electronic low-voltage linear amplifier designed to increase the speed and accuracy of low level d-c voltage measurements. Discusses performance and construction features of the amplifier, and describes some applications. Specifications and ordering suggestions given. Hagan Corp.

119 Electric Tachometers — Twenty-pp Bulletin 540 features company's small, rugged electric tachometers for production control, speed indicating, or checking applications. Included are ten Magneto types with accessories for connecting magnetos to the drive source through direct coupling, pulleys, chain-and-sprockets, spur gears, or friction contact. Several panel indicators with scale lengths from 3½ to 17½ in. are described. The Electric Tachometer Corp.

VALVES, TRAPS AND PIPING ACCESSORIES

120 Valve Data in Brief — Bulletin V-1 is designed to show power engineers, briefly, some of this manufacturer's current valve types. Illustrates and describes bleeder check, boiler feedwater, venturi reducing, heater bypass, balanced butterfly and atmospheric relief valves, also a new high pressure strainer. Includes information on design features and their specific advantages and on construction and application. Schutte & Koerting Co.

121 Bronze Valves — Catalog B255 is a 6-pp condensed ordering guide covering 55 types of bronze valves for heating and plumbing. Provides description, sizes, weights on gate, globe, angle and check valves, manifold header units, strainers, relief valves. Catalog is illustrated, arranged for easy use. Milwaukee Valve Co.

122 Solenoid Operated Valves — This comprehensive 54-pp catalog on solenoid-operated valves describes five basic electric valves and discusses many possible variations. Covers company's Universal line offering flexibility at low cost; all-purpose four-way line offering precision cylinder control; miniature cut-off line; high-pressure hydraulic line; and a high flow industrial line for workhorse performance. How to choose valves for various applications is explained. Book is generously illustrated with photos, operational sketches, flow charts, selection charts, dimensional drawings. Includes price list. Skinner Electric Valve Div., The Skinner Chuck Co.

123 Improved Bronze Valve — Circular 602 describes and pictures a bronze globe valve featuring both a new design and a new wear-resistant alloy utilized in the seat and disc. Special construction features of this valve are shown and advantages offered by the new design are explained. Includes dimensions, lists services for which the valve is well suited. The Lunkenheimer Co.

124 Materials Handling Valves — Data Sheet DVa covers design, operation and advantages of company's Type C materials handling valves. Photos, schematics and line drawings are used to illustrate valve construction and operation. Advantages in pneumatic ash handling systems are listed. Control techniques that can be employed with air-electric, remote or manual operation are discussed. The Allen-Sherman-Hoff Co.

125 Feeders, Rotary Valves — Bulletin F-5, 8 pp, describes and illustrates roll and vane-type feeders and rotary valves for handling a variety of dry pulverized and granular materials. Discusses various types of feeders and lists materials handled by them. Generously illustrated with photos and drawings, this bulletin includes tables giving key dimension and capacity figures. Fuller Co.

126 Steam Trap — Revised Bulletin 255-A describes company's thermodynamic steam trap and explains why it requires little maintenance. Lists 13 design and operation features and includes data on operating pressures, capacities, dimensions and weights. Sarco Co., Inc.

127 Expansion Joints — Rubber expansion joints for relieving strains and stresses in piping, absorbing vibration, and eliminating noise are the subject of 8-pp Form AD-137. General advantages of rubber expansion joints are presented, and spool-type U-type and rectangular-type joints are described as to construction and intended services. Also provided is catalog sheet on all-Teflon joints and Teflon-lined rubber joints. The Garlock Packing Co.

128 Industrial Strainers — Five models of strainers for the removal of suspended particles from all types of liquids are covered in this brochure. They include automatic self-cleaning strainers, manually-operated self-cleaning types and twin-basket models. Brochure is a collection of several product bulletins on the strainers and provides photos, dimensions, capacities, installation suggestions and engineering information. S. P. Kinney Engineers, Inc.

SPACE HEATING, VENTILATING

130 Gas Unit Heaters — Bulletin B-55-US presents specifications, dimensions and construction details on suspended gas unit heaters. Includes propeller fan and centrifugal blower powered units in eight sizes from 25,000 to 200,000 Btu, plus a new twin-fan 250,000 Btu model. Reznor Mfg. Co.

131 Heating, Ventilating Equipment — The 40-pp spring and summer 1955 edition of this company's estimating catalog covers heating, ventilating, refrigeration and air conditioning equipment. It is fully illustrated and includes prices, necessary ordering information. Specially prepared tables permit quick selection and pricing of blowers, fans, coils, evaporative condensers, valves and fittings. Booklet also introduces an extended line of air conditioning units, cooling towers and evaporative condensers to 100 tons. M. Blazer & Son.

132 Ventilating Sets — Quiet operation, rugged construction, lower costs and other advantages of Util-A-Vent sets are stressed in 30-pp Bulletin UVS 103. These sets are designed for low cost handling of applications requiring low and medium ranges of air capacities. Bulletin presents dimensional and capacity data on direct-driven units with forward curved wheels, and belt-driven units with forward curve or backward blade wheels. Performance curves are included, and some right and wrong duct installations are pictured. General Blower Co.

PUMPS AND COMPRESSORS

133 Centrifugal Pumps — Built to handle high static heads, the pumps described in 6-pp Bulletin 350 feature single-stage, double-suction centrifugal design. A large cutaway illustration shows construction details of the pumps. General and metal specifications are provided, and tables give performance data on pumps from 85 to 4500 gpm, heads to 195 ft. American-Marsh Pumps, Inc.

134 Two-Stage Pumps — Bulletin C-1054 describes company's two-stage Type DMD pumps for boiler feeding, other services. Construction features are illustrated, including dimension tables for various pump sizes. Economy Pumps Div., C. H. Wheeler Mfg. Co.

135 For Efficient Pumping — Bulletin 52 B 6083C, 6-pp, discusses easy installation and maintenance and other advantages of company's "Electrifugal" pumps, available in capacities to 2500 gpm, heads to 400 ft and temperatures to 250 F. Pump types described include those having a casing with removable suction cover and those having a casing with suction and discharge nozzles in one piece. Alternate sealing arrangements are also described. Allis-Chalmers Mfg. Co.

136 Jacketed Pumps — Section E, 12-pp, features company's line of jacketed pumps for handling heavy viscous liquids such as heavy petroleum, organic oil, chocolate, enamels, printing ink, greases, coal tar, soap solution, molasses and others. Presents data on design and construction, as well as specifications and schematic drawings for each of the pumps in the series. A cutaway view shows component parts. Viking Pump Co.

137 High Vacuum Pumps — Illustrated Bulletin V-54, on high vacuum pumps, gives construction and operating characteristics of single stage, compound and two-stage mechanical booster types. Controlled gas ballasting, and other methods of eliminating oil contamination vapors are explained. Photos are included, and line drawings indicate vapor flow and operating cycle. Kinney Mfg. Div., The New York Air Brake Co.

138 Small Chemical Pumps — Small rotary displacement and centrifugal pumps for chemical service are described in this illustrated bulletin. Among models detailed are stainless steel, synthetic rubber and bronze low-volume pumps with interchangeable Teflon, Hypalon, Neoprene, Carbon or Formica impellers. A table of recommended uses, specifications for each unit and photos of conventional types of mountings and drives are included. Eco Engineering Co.

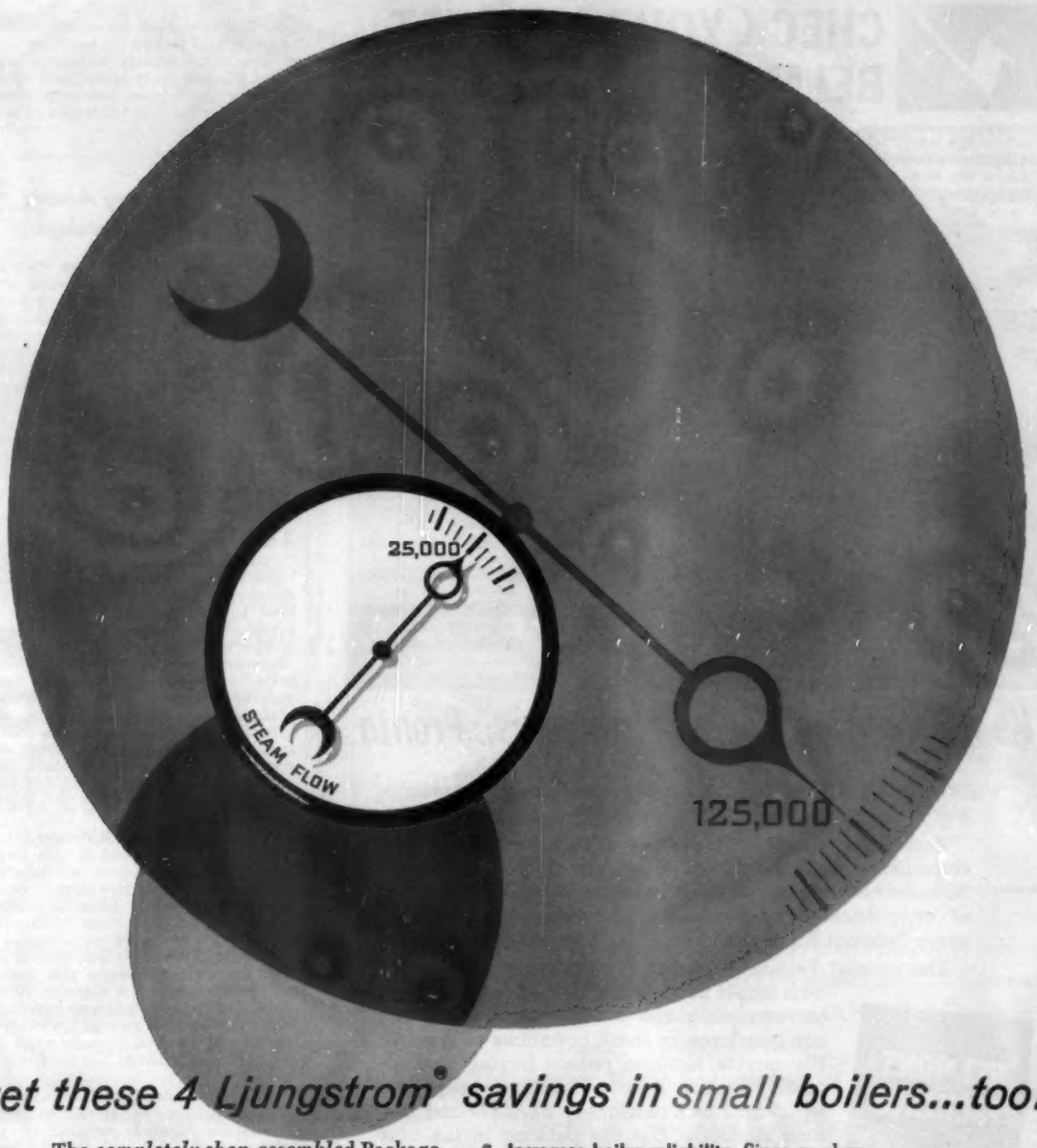
You'll save time in ordering bulletins by using the Reader Service Cards on page 97. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

139 Condensation Pumps — Eight-pp Bulletin 1403 describes company's line of condensation pumps for use in low and medium pressure-heating systems and steam-process equipment. Photos, drawings and other technical data on capacities and dimensions pertaining to construction, application and installation are included. C. A. Dunham Co.

140 Pumps in Paper Mills — Sixteen-pp Bulletin 455 shows how paper mill operators can employ controlled volume pumps to meter chemicals in stock preparation, bleaching, coating, slime and foam control and in water treating. Actual case histories of installations cover use of controlled volume pumps to upgrade product quality, eliminate chemical waste. Milton Roy Co.

141 Proportioning Pumps — Provided in this bulletin (about 6 pp) is selection and application information on proportioning pumps for chemical additive injections, for batch, semi-batch or automatic systems. Data is compiled in easy-to-use tabular form. Schematic layouts are included. Hills-McCanna Co.

142 Pumps and Compressors — Bulletin 603, 6-pp, is a brief catalog describing air and gas compressors, dry



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. . . Outstanding Among This Month's Catalogs

143 Controlled Volume Pumps — Bulletin 953, 24-pp, describes and illustrates use of controlled volume pumps in industrial water treating systems. Construction and operation features are described, capacity-pressure ranges and speed and stroke length adjustments are charted. Typical chemical feed and water treating systems are presented through text and diagrams; and an analysis of boiler water treating systems, cooling water treating problems, and systems for waste and sanitary water treatment included. Milton Roy Co.

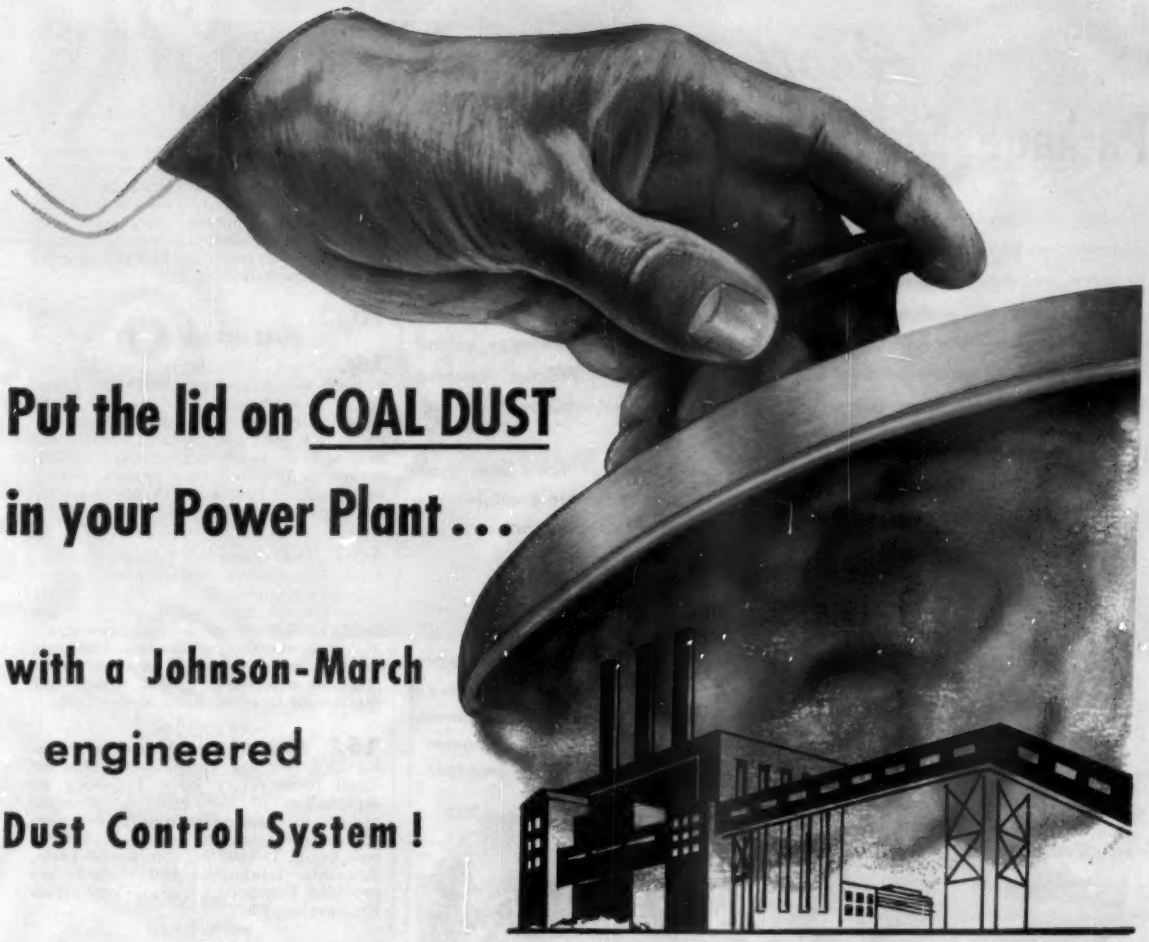
144 PM for V-Belt Drives — Prepared in the interest of avoiding breakdowns, this 28-pp preventive maintenance manual is filled with practical tips on keeping V-belt drives in good working condition. Treats mechanical interference, pulley misalignment, mismatched belts, worn belts, belt tension, pulley groove wear, wobbling pulleys, belt temperatures and V-belt construction. Booklet also gives features of manufacturer's Thorobred V-belt, Cog-belt, fhp V-belt and connector type V-belt. A chart lists seven warning signs of short V-belt life. Dayton Rubber Co.

145 Absorption Refrigeration Machines — Described in this 36-pp catalog are absorption refrigeration machines which produce large-capacity cooling from steam, have no moving parts, and use plain water as a refrigerant. These machines are produced in capacities of 100 tons and up and are used for air conditioning and process refrigeration. Booklet explains refrigeration cycle, and illustrates important features. Capacity ratings are listed in tables and physical characteristics for 22 models are charted. Carrier Corp.

146 Handbook on Insulation — This 80-pp revision of the Magnesia Insulation Manual contains an explanation of chemical and physical properties of 85 per cent Magnesia, together with new conductivity, density, and fire-resistance data. Water-resistant magnesia insulation for underground conduits and locations subject to excessive moisture is described. A section is devoted to application techniques for hot piping and equipment. Includes tables of simplified thicknesses — in nominal and actual thicknesses. Recalculated heat loss tables included. Available to qualified power engineers, please state your job title. Magnesia Insulation Manufacturers Ass'n.

PACKING

148 Rubber Packing — Sheet rubber packing material, made by company's Rotocure process, is described in this illustrated bulletin. Points out advantages



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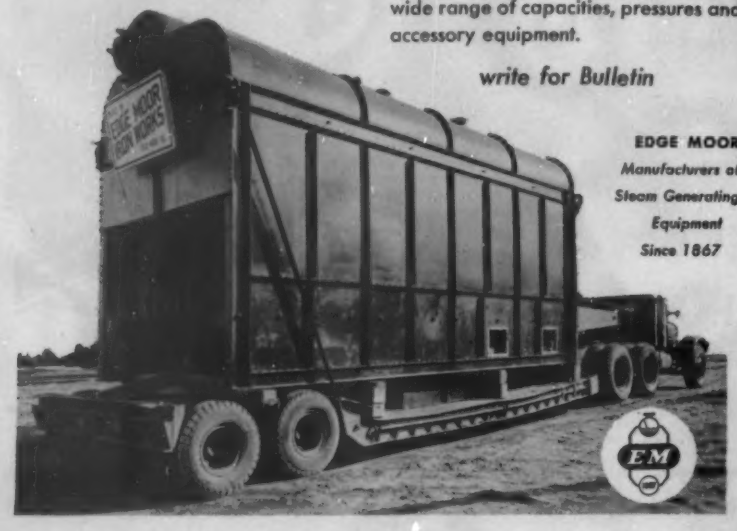

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— such as stability, smoother finish, better gage control. Describes applications. Boston Woven Hose & Rubber Co.

149 Molded Rubber Products — Eight-pp Bulletin H-20 presents company's line of molded rubber goods and industrial sheet packing. Contains specification chart comparing qualities of six types of natural and synthetic rubber. Also lists 10 all-purpose pure gum and synthetic rubber sheet packing and recommended uses for each, and includes specifications. Hewitt-Robins, Inc.

FUEL HANDLING

150 Fuel Oil Heating — Eight-pp Bulletin 1644B discusses the electric heating of fuel oil suction piping and thermostatically controlled electric line heaters for No. 6 oil. Some typical electric oil heating systems are diagrammed. Booklet covers use of electric line heaters, ribbon heat, and suction stub electric heaters. Preferred Utilities Mfg. Corp.

151 For Burning Refuse Fuel — This 8-pp bulletin describes refuse fuel burning equipment, including a pneumatic refuse fuel distributor which spreads refuse fuels such as bark, wood chips, and bagasse uniformiy over the grate surface. Discusses construction features of various components, selection of grates, design and engineering features. Riley Stoker Corp.

152 Bowl Mills — Sixteen-pp Catalog 75 presents a line of bowl mills for direct firing rotary kilns. Following an explanation of the grinding principle utilized in these mills, booklet discusses operating features, and advantages of bowl mill firing. Details on component parts, automatic lubrication and controls are provided. Raymond Division, Combustion Engineering, Inc.

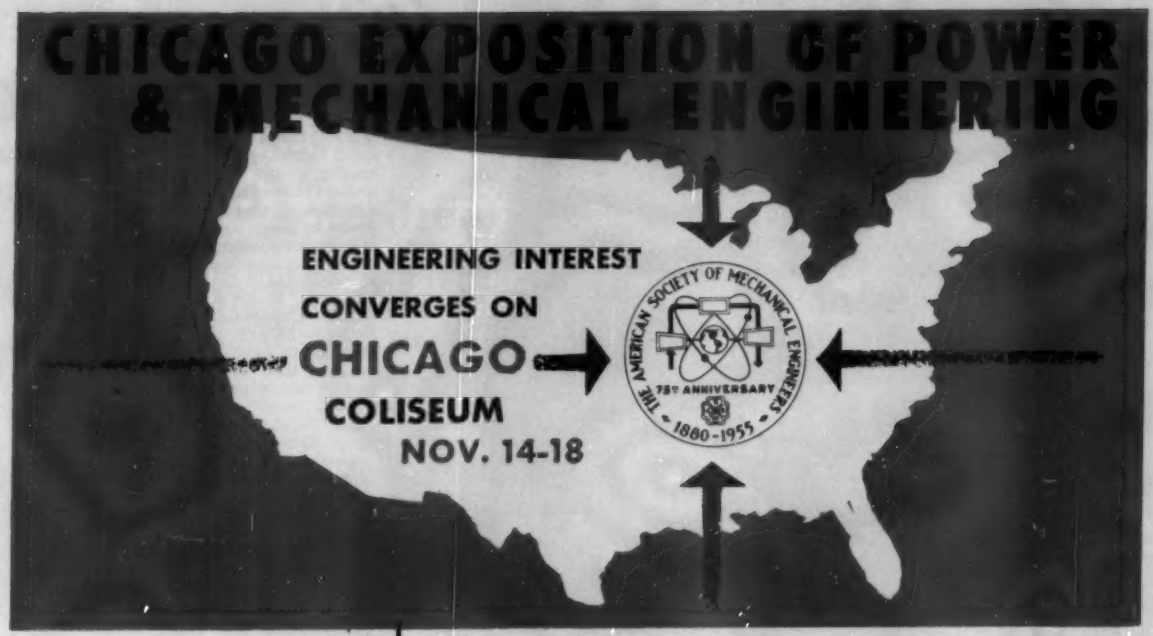
153 Screw Conveyor — Form A-121 describes and illustrates a direct-feed bin-to-stoker screw conveyor designed to move 1000 lb of coal per min and avnilable as a unit in lengths of 10 to 40 ft. Advantages of the conveyor are stressed and some applications pictured. Baughman Mfg. Co.

154 Bulk Conveyors — Twelve-pp Bulletin 455 describes and illustrates bulk conveyors for handling coal, also ashes, sand, gravel, stone, chips, aggregate, logs. Photos show these conveyors in a wide range of industries. Drive and take-up units and other components are illustrated in detail. Jervis B. Webb Co.

TAPE PRODUCTS

155 Two-Purpose Tape — This brochure on a "2-in-1" electrical tape discusses application of one tape doing the work usually performed by a heat-curing tape for baking and self-sticking tape for holding and insulating. A table of technical data illustrating the curing cycle, tensile strength and seven other pertinent factors relating to backing of these tapes is included. Permacel Tape Corp.

156 Tape Products — Bulletin 455, 8-pp, describes company's major tape products, providing performance and application information on Bi-Seal self-bonding insulating tape, electrical filler tape, BiPrene types "C" and "H" electri-



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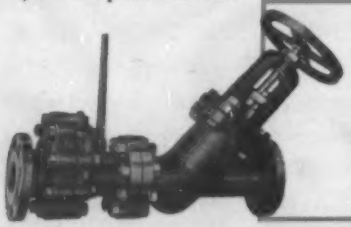

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cal jacketing tape, general purpose vinyl electrical tape, and high voltage splicing tape. The Bishop Mfg. Co.

OTHER EQUIPMENT

157 Hot Water Heater — Bulletin 920-A introduces the Iso-Therm hot water heating system for providing a maximum amount of constant temperature hot water with a minimum amount of boiler horsepower available for hot water loads to 900 gph. Bulletin covers design and operation, installation, applications. Fred H. Schaub Engineering Co.

158 Compressed Air Handbook — Bulletin 520, 8 pp, provides hook-up sketches to help users of compressed air improve their installations. Covers location of air intake, intake pipes, cooling system, temperature control of cooling water, safety alarms, aftercooling, drain traps, distribution lines, separators, other factors. Also gives descriptive and application information on cooling controls for compressor jackets, aftercoolers and intercoolers. Sarco Co., Inc.

159 Protective Helmets — Bulletin 0600-3, 16-pp, describes a line of Skullgard helmets developed for industrial workers and others. A pictorial essay traces each step in the molding of Skullgards, and describes testing processes employed. Reinforced and high-pressure plastic headgear, and hats made of glass fiber and aluminum described. Mine Safety Appliances Co.

160 Steel Plate Fabrication — Pictured in this 20-pp brochure are important steps in the fabrication of steel plate into breechings, intricate duct work and high stacks. Shows how ideas drawn up in the drafting rooms take shape. Connery Construction Co.

161 Electrical and Lubricating Devices — Condensed Catalog 55, 8-pp, is a descriptive listing of company's electrical and lubricating devices, featuring illustrations, catalog numbers, sizes, general engineering data, ordering information. Trico Fuse Mfg. Co.

162 Cupro Nickel Alloys — The use of cupro-nickel alloys for heat exchanger tubes in power service, due to their resistance to salt water used for cooling and superior strength at elevated temperatures, is discussed in this 12-pp bulletin. Provides tabulated data on performance in specific service in various industrial fluids such as ammoniacal solutions, brines, alkaline solutions, petroleum products, organic compounds and others. The International Nickel Co., Inc.

163 Air Cylinders — Bulletin 125, 6 pp, describes over 1900 mounting size and control combinations of standard Power Pack air cylinder with built-in valve. Gives ordering data on rods, valving, port orientation, parts and mounting styles for these units intended for applications where automatic or semi-automatic motions are required. Carter Controls, Inc.

164 On Metal Grating — Sixteen-pp Form 500 is a data and specification manual covering all types of grating, open steel floor armor, stair treads, vessel liners, decking and drain grates. Contains safe load tables for basic types of gratings, panel width constant charts, tables on standard widths and types of steel treads, types of anchors used for grating, use of grating. Klemp Metal Grating Corp.

four different water supplies from one water treatment plant by GENERAL FILTER

The Plains Electric Generation and Transmission Co-operative recently completed at Algodones, New Mexico, provides 30,000 kilowatts per hour to Southwest consumers.

A water treatment plant capable of delivering adequate quantities for four different supplies was required by the consulting engineers:

- COOLING WATER for the condensation of turbine steam.
- SANITARY WATER for drinking and sanitation.
- MAKE UP WATER for the boilers.
- SERVICE WATER for fire protection and general utility.

With the system installed one operator can check, alter and control the treatment process from a master control panel . . . confident of complete dependability . . . minimum maintenance.

AERATORS • FILTERS • TASTE AND ODOR • ALKALINITY CONTROL • HIGH CAPACITY RESINOUS ZEOLITE • IRON RUST REMOVAL • DEMINERALIZATION • SOFTENERS

Ask for recommendations for a water treatment plant "job-engineered" to your requirements . . . a fast, efficient, economical system by General Filter.

General Filter Company
AMES, IOWA

"yours for better water treatment"

For more data circle 522 on Post Card

Bailey Recorder for receiving pneumatic and electric signals.

Pick any four, plug in, and record

Here is a receiver recorder, custom-built *by you* to meet your needs, no matter how changeable, how complex. On a single chart you can record any four measured variables—and interchangeable receivers permit new combinations almost at will.

Individual plug-in pneumatic or electronic receivers—and corresponding integrators—are interchangeable in the four identical frame slots. You can select any combination; even including two receivers and their two integrators.

Think what this can mean to you! Parts inventories are minimized; re-use of components keeps instrumentation costs economically low when cycle changes are frequent—and you can even tie in with your existing transmitters.

Ask for Product Specification E12-5.

Measured Variables

- % combustibles
- combustion
- conductivity
- density
- differential
- draft
- flow
- liquid level
- % oxygen
- pH
- position
- pressure
- ratio
- smoke density
- specific gravity
- speed
- temperature
- vacuum

P10-1

ONLY BAILEY OFFERS ALL THESE ADVANTAGES IN A SINGLE RECORDER

- Pre-calibrated plug-in receiver units
- Up to four pneumatic or electronic receivers —or two receivers and two integrators
- Any four variables on one chart—easily read and interpreted
- A full year's ink supply at one loading
- Faster ordering—from stock
- Minimum inventory of parts
- Minimum instrument investment for process cycle expansion or alteration

BAILEY METER COMPANY

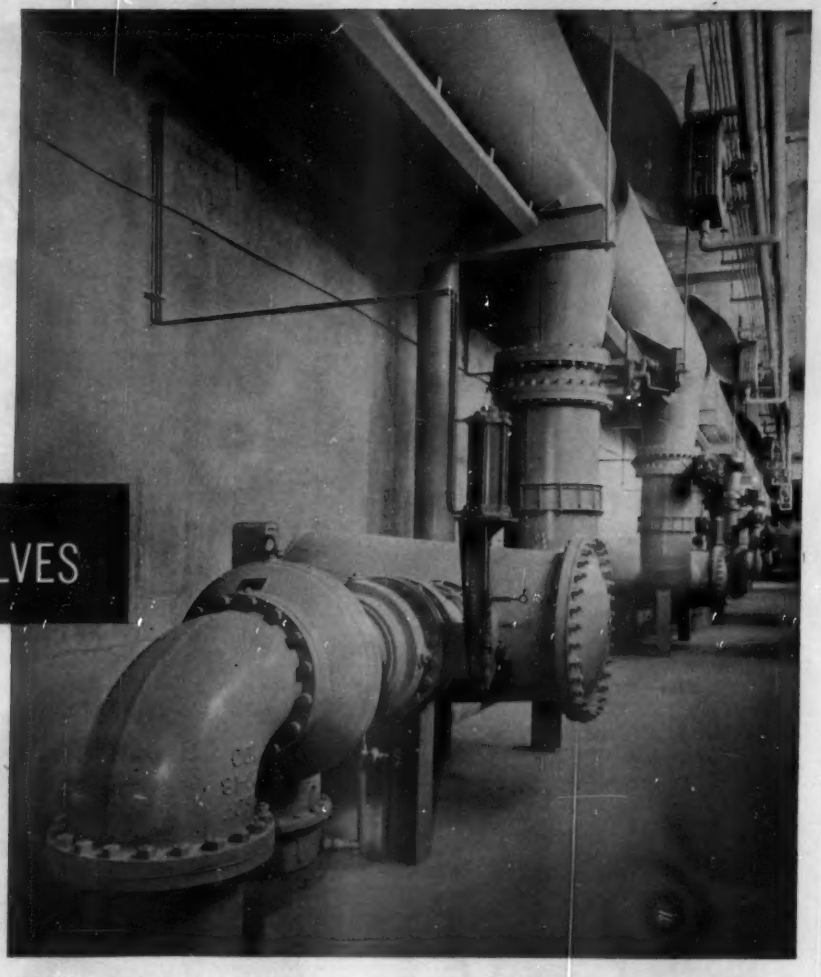
1040 IVANHOE ROAD

CLEVELAND, 10, OHIO

Controls for Power and Process

Controls for
TEMPERATURE
PRESSURE
GAS ANALYSIS
FLOW LEVEL
RATIO DENSITY

For more data circle 523 on Post Card



San Jacinto Project uses 65 large R-S Butterfly valves

CITY OF HOUSTON SAVES $124,000 with DROP-TIGHT RUBBER-SEATED VALVES

Choosing R-S Rubber-Seated Butterfly Valves enabled Freese, Nichols & Turner, Consultants on the San Jacinto River project, to save $124,000 for the City of Houston. Use of 65 of these valves for all low-pressure service gave a substantial space reduction and the direct, in-place cash savings over gate valves. SMS cone check valves were also chosen for pump discharge service.

Positive closure in R-S Rubber-Seated Valves is obtained by wedge-type closure of the disk within a one-piece rubber seat. Tough, flexible rubber seals the entire disk seat – including the area around the shaft bosses. Supervised testing of a six inch R-S Rubber-Seated Valve proved that after 6,000 closings the valve was still giving positive shutoff at 100 psig water.

These valves are the product of over 75 years of design and engineering experience in the hydraulics field. To find out more about our complete line—R-S Butterfly, Rotovalves and Ball Valves – write to S. Morgan Smith Company, York, Pennsylvania.

Hydraulic Turbines
Pumps
Gates & Hoists
Trash Rakes
Accessories

HYDRODYNAMICS

Rotovalves
Ball Valves
Butterfly Valves
Free-Discharge Valves
Controllable-Pitch Ship Propellers

S. MORGAN SMITH CO.

AFFILIATE: S. MORGAN SMITH CANADA, LIMITED, TORONTO

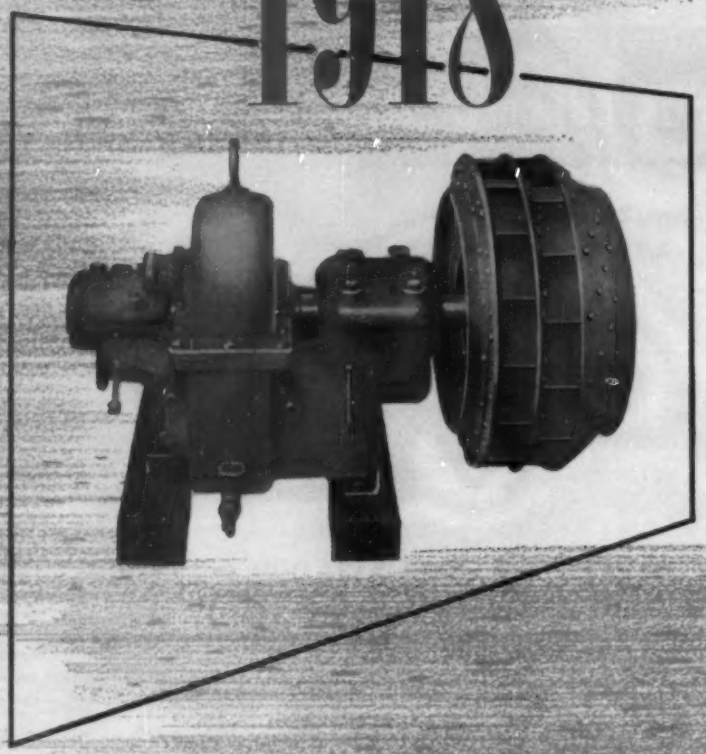
For more data circle 524 on Post Card

Announcing 1918

1918 TYPE OF GREEN AIRFOIL FANS

Typical of the scores of AIRFOIL Type Fans we designed, manufactured, and shipped some 35 years ago. Some of these units are still in service.

These two drawings with dates in the World War I era show details of the Green AIRFOIL Type Fans as designed and manufactured by us in those days.



We use the word 're-opening' purposely for in 1918 at our factory in Beacon and for a few years thereafter we designed, manufactured and shipped many AIRFOIL Type Fans. *The AIRFOIL Type of Fan is not new.* But it has been modernized, refined and improved. Basically, the 1955 fans are not unlike the 1918 units. The blades then and the blades today simulate the design of the airplane wing. Then, as today, this type of blade produces considerably higher mechanical and static efficiencies than other types of blades.

The 1955 Line of Green AIRFOIL Type Draft Fan consists of six (6) different design variations which provide wide latitude in the choice of volume-pressure combination. Conservatively rated—as has always been a Green policy—these fans show exceptionally high static and mechanical operating efficiency.

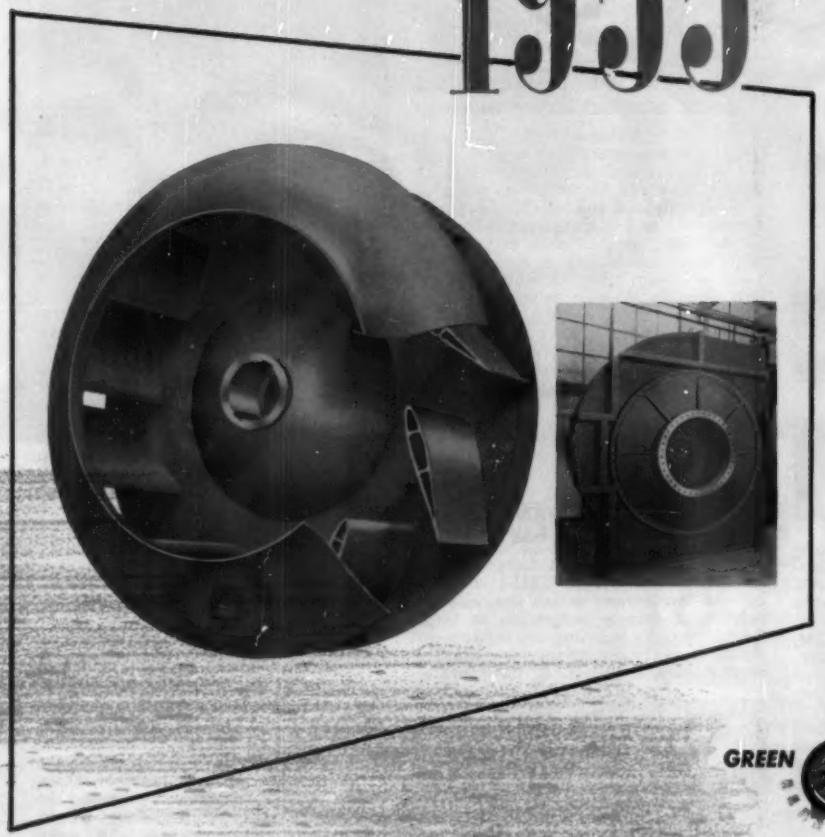
We are designating our line of AIRFOIL Fans as the GALEX Fans. They really deliver gales of air.

Complete details of the Green AIRFOIL Fans will be sent on request. Our engineers will be glad to discuss your fan requirements if you have any specific questions.

THE RE-OPENING OF THE LINE OF GREEN AIRFOIL TYPE FANS

1955 VERSIONS OF 1918 DESIGNS

1955



1955 VERSION OF AN AIRFOIL TYPE FAN

GREEN THE AIRFOIL TYPE FAN Galex FAN

GREEN
POWER AND PROCESS PLANT EQUIPMENT

FUEL ECONOMIZER COMPANY
BEACON 3, NEW YORK

For more data circle 525 on Post Card

EQUIPMENT NEWS

1—POLYPHASE MOTORS for general purpose use

Type DP Motors are ball-bearing polyphase motors in rerated NEMA frame sizes 182 through 326. For indoor or outdoor use, these motors have corrosion-resistant cast iron frames, contoured so that moisture does not collect on the surfaces. Manufacturer says their construction is so dripproof they can be used for many applications formerly requiring splashproof motors. Ventilating air intakes are at the bottom of the endplates and air outlets positioned at the base of the frames on each side. Baffle plates direct air into the blower and through the motor and also provide extra protection for the stator windings. Motors will come in 1 to 30 hp, three phase 60 cycles, 1750 rpm. Bulletin MU-202 gives details. Wagner Electric Corp.

2—GEARED-HEAD WRENCH generates high torque

This "4-to-1" geared-head wrench is announced for heavy assembly and disassembly work requiring rotary effort over 200 ft-lb. An intermediate unit, the X-4 is designed for use with ratchets,

torque wrenches, sockets, and attachments. Torque is produced through planetary gears. A rugged unit, the X-4 is lightweight and portable — declared ideal for work in close quarters. Known 4-to-1 ratio permits its use as a multiplier for torque wrenches, says company, and in tightening or loosening threaded parts there is no snap or jarring action. Easily used, this wrench has a drop-forged, heat-treated chrome-moly steel head. Stressed parts are heat-treated alloy steels, it is noted, and head and shafts are sealed and lubricated for life. Bonney Forge & Tool Works.

Described on these pages are new and improved products. Use Reader Service Cards on pages 97–98 to ask for more information on them. Just circle the item numbers of all the products in which you are interested.

3—CONVEYOR BELT is extra strong, pliable too

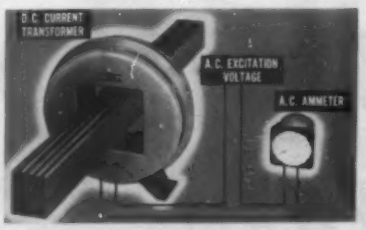
Reinforced with a new synthetic fabric called Super Raynile, this conveyor belt is claimed to be 400 per cent stronger than most cotton reinforced belts. It has been developed for transporting coal, ore, crushed stone and other bulk materials over long distances and up steep grades. Despite its high strength, this belt is pliable and flexible, says manufacturer. Also it is less expensive than steel-reinforced belts and can be spliced quickly and economically in the field without special equipment. It will be manufactured in widths up to 72 in. and in thicknesses ranging up to 15 plies. Hewitt-Robins Inc.

4—WATER SOFTENERS are small, compact industrial units

These zeolite water softeners are made in 13 standard sizes with flow rates from 6.5 to 40 gpm. Flow rates are said to satisfy demands for small volumes of soft water in food and processing plants, commercial and institutional laundries, power plants, textile plants, and potable water supplies. Simple in design, these water softeners offer convenient operation through a single multiport valve. They can be supplied with either automatic or semi-automatic controls. In automatic operation, the steps of backwashing, brining, rinsing, and return to service are carried out automatically. With semi-automatic operation, initiation of the regenerative cycle is controlled by push button. Industrial Filter and Pump Mfg. Co.

5—D-C CURRENT TRANSFORMER slips over bus or cable

Formerly designated the d-c measuring reactor, the new Type JSU-1 is a d-c current transformer which provides for permanent remote indication of large d-c currents by isolating the instrument circuit from the d-c circuit when making current measurements. It incorporates



a window-type design which lets the transformer be slipped over d-c bus or cable. Manufacturer recommends the Type JSU-1 for applications on electrolytic cells which require large d-c currents for the production of aluminum, chlorine, magnesium, and zinc — also for use as a feedback source to current balance regulators, d-c voltage regulators, motor field and pumpback-current control regulators.

It is reported that this new transformer offers reduction of electrical hazard to personnel and equipment by isolating the indicating instrument from the main bus voltage. Also, installation expense may be decreased since no special, bolted-bus connections are required, says company, and operating expenses are lowered due to the elimination of power drain from the circuit being measured. General Electric Co.

6—VOLUMETER weighs material on moving conveyor

This Volumeter is designed to record the weight of material on a continuously moving conveyor even though it may stop at undetermined intervals. Relying on the constant volume of material being conveyed, unit can be calibrated to record integrations of any conveyor load.

If volume of material should vary, manufacturer points out, the Volumeter automatically shuts down the conveyor.

No outside power is needed; the device is actuated by contact with moving material on conveyor. The unit is mounted on conveyor housing, and its wheel rides on the material being conveyed. A cam on the end of the shaft actuates a relay switch. The counting impulse thus produced is carried electrically to a remote counter, calibrated to record weight of material passing over conveyor. If the volume of material decreases, the wheel and, in turn, the stop screw on the yoke are lowered making contact with a limit switch which stops conveyor. The limit switch can also be set up to sound an alarm, and also to actuate an air vibrator on the hopper feeding conveyor to relieve jamming. Bulletin R-35 gives further information. Roto Div., Elliott Co.

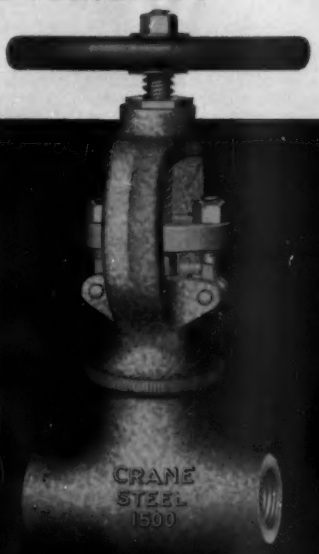
7—INDICATOR SYSTEM keeps a watch on smoke density

A method of keeping smoke discharge within limits of smoke control and air pollution ordinances is offered with the Fireye Smoke Density Indicator System FE-3. For use with the system, three smoke density recorders, Series 55, are available. The system consists of a light source, photoelectric scanner, and smoke density indicator. Light source and scanner are installed on the stack or breeching so that the light beam is aimed directly at the lens of the scanner. The density of smoke obscuring the light beam is measured and indicated directly on the smoke density indicator in terms of both smoke density and Ringelmann number. An alarm relay is provided for operating an external alarm at any preset density value.

Of the three recorders, the Type

Why buy small high-pressure valves that lack these CRANE features?

New 1500 and 2500 pound check patterns . . . screwed or socket welding ends; ½" to 2". Patented construction assures high disc lift, free flow and minimum pressure drop.



1500 and 2500 pound globe patterns... screwed or socket welding ends; ½" to 2".

1500 and 2500 pound angle patterns... screwed or socket welding ends; ½" to 2".

When you buy CRANE Lip-Seal Bonnet Valves . . . designed exclusively for high pressure/high temperature power plant service . . . you are assured of:

- lip-seal welds that are laid on flat surfaces — needn't be chipped out or burned out;
- easy dismantling and reassembly — bonnet screws out after weld is *ground away* — makes inside of valves entirely accessible;
- bonnet threads are chrome plated to prevent galling or seizing;
- stems that do not bind or gall — because of CRANE's exclusive ball-joint glands;
- easy access to stuffing box — swing-type gland eye-bolts swing free of yoke area, can't be lost;
- a more rigid swivel disc-stem connection that minimizes vibration;
- each size valve is a separate design for proper proportion — another CRANE exclusive.

Specify "Crane Lip-Seal" when you want small valves for high pressure/high temperature steam service. For more reasons why you should do so, ask your CRANE representative for Circular AD1902, or write direct. CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. Branches and Wholesalers Serving All Industrial Areas.

CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

For more data circle 526 on Post Card

55AKI Smoke Time Recorder may be used for continuous recordings of smoke conditions over 24-hr periods. It records periods of excess smoke on a 12-in. chart, showing both time and duration. The Type 55AL1 Smoke Time Recorder provides 8-in. chart records of time and duration of excess smoke from two or more density indicators. The Type 55AM1 Smoke Density Recorder provides a continuous record on a 12-in. chart. Installation Bulletin CM-32 gives full details. Combustion Control Div., Electronics Corp. of America.

8—FLANGELESS WIREWAY is equipped with hinged covers

In addition to having hinged covers which swing open for faster installation of wiring, this new line of flangeless wireway includes auxiliary fittings with hinged covers, too. This makes possible a complete, unbroken wireway system

in which conductors can be "laid-in," rather than "fished through." The preassembled covers are hinged to the wireway and fittings on one side of their length — when opened they provide accessibility to conductors.

The wireways come in five sizes from 2½-by-2½ in. to 8-by-8 in., and in five standard lengths from 1 to 5 ft. Auxiliary fittings in corresponding sizes include 90 deg elbows and pull boxes, T fittings, 45 deg elbows, closing plates, U connectors and panel adapters. It is pointed out that this range of sizes makes the new hinged cover equipment suitable for use as wiring trough and auxiliary gutters, as well as for connecting loadside switches, meters. Keystone Mfg. Co.

9—RECORDING INSTRUMENTS simplify maintenance

The Type 44 line of direct-acting recording instruments is designed to simplify maintenance and operation, provide improved reliability, and permit substantial reductions in space requirements. The recorders are available as ammeters, voltmeters, wattmeters, varmeters, and frequency meters in models for portable use or for switchboard mounting.

A forward-tilting chart drive mechanism permits adjustments and maintenance to be made from front without removing instrument. Inking system includes an inkwell that can be filled without disturbing pen; all moving parts, including pen, can be removed without disturbing stationary parts. Supplied in a steel case and finished in black enamel, each recorder is 5 13/16 in. wide, 12 13/16 in. high, and 10 5/16 in. deep. Westinghouse Electric Corp.

10—STRAPPING TOOL makes metal strap easily workable

Claimed to make metal strap as workable as a rubber band, the Royal HL Strapper is self-contained to tighten and cut ferrous and non-ferrous metal strap, forming its own clamp. This time-saving tool can be used for binding armatures,

clamping insulation on cables, holding and bundling cable. It is designed to make permanent clamps of any size, and is compact and light in weight (1¾ lb). According to manufacturer, it needs no support other than the hand to work in small spaces and high spots, forming clamps as small as 1 in. The strapping for use in the tool can be supplied by the same company in several metals, in four widths from 5/16 to ¼ in. and 29- to 25-gage. Independent Metal Strap Co., Inc.

11—SUBMERSIBLE PUMP for transformer vaults, sumps

This submersible pump for cable and transformer vaults, manholes, and other sumps is designed for dependable underwater service. Motor and pump are housed in a watertight case only 11⅛ in. high, so that entire unit is placed in sump. Water rising in sump, traps air in skirt of the switch, creating an air head. When water rises to predetermined height, air head flexes a diaphragm in switch, closing switch contacts and starting motor. This switch design is said to eliminate electrodes that foul, floats or switch plungers that stick, and rods that bend.

The pump can never be drowned out or flooded, manufacturer states, and if power failure occurs, motor cannot be damaged. Capacities range to 3,300 gph. A ½ hp motor drives the pump and is hermetically sealed in a case filled with insulating oil. Standard turn on head is about 9 in. from the floor. The pump shuts off when water is removed to within 5/16 in. from floor. Available in 115 and 230-v a-c in three models — 109N for continuous or manual operation; 109A for automatic operation; and 109MA when manual starting is desired with automatic stopping. Kenco, Inc.

12—DEMINERALIZER for users of 200 gph of high purity water

Designed to provide the efficiency of mixed bed ion exchange action together with automatic operation of all functions, including the regeneration cycle, the Model MA-200 is a compact, packaged unit. For installation this mono-column demineralizer requires a minimum of floor space, connection of influent to the plant's water system, and connection of effluent to those points where high purity water is required . . . boiler feed, process lines.

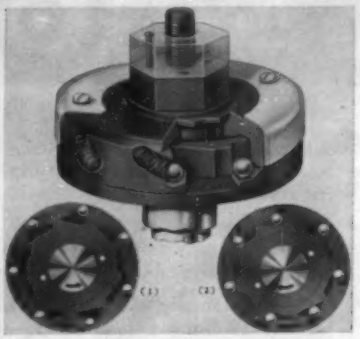
Raw water enters the unit at the influent and after passing only once through the mono-column of mixed cation and anion resins, is received at the effluent stripped of impurities. A flow meter on the influent enables setting water intake at an optimum rate for exchange action, and an electric purity meter plus automatic controls govern purity of effluent. Once installed, all operating factors of this demineralizer, including regeneration cycle, become automatic. It is explained that when the effluent's conductivity falls below standard, the treated water is automatically discharged and lights signal the need for activation of a regeneration cycle — which is initiated by the turn of a switch. Penfield Mfg. Co., Inc.

13—PRIMING PAINT for galvanized iron or sheet zinc

All-weather protection for galvanized iron or sheet zinc is claimed to be provided by Zincoater, a priming paint. Zincoater is based on a formulation combining zinc dust and a vehicle to form a smooth continuous film. Manufacturer of this priming paint says it protects new metal better than galvanizing; and finish coats, for decoration or appearance, cling tightly to Zincoater, which gives an eggshell finish. It is suggested for use on galvanized iron building surfaces or towers, heating or air conditioning ductwork, and water tanks. According to company, Zincoater does not affect the purity of water for either drinking or manufacturing purposes. Tropical Paint Co.

14—PUMP MOTOR incorporates protection against backspin

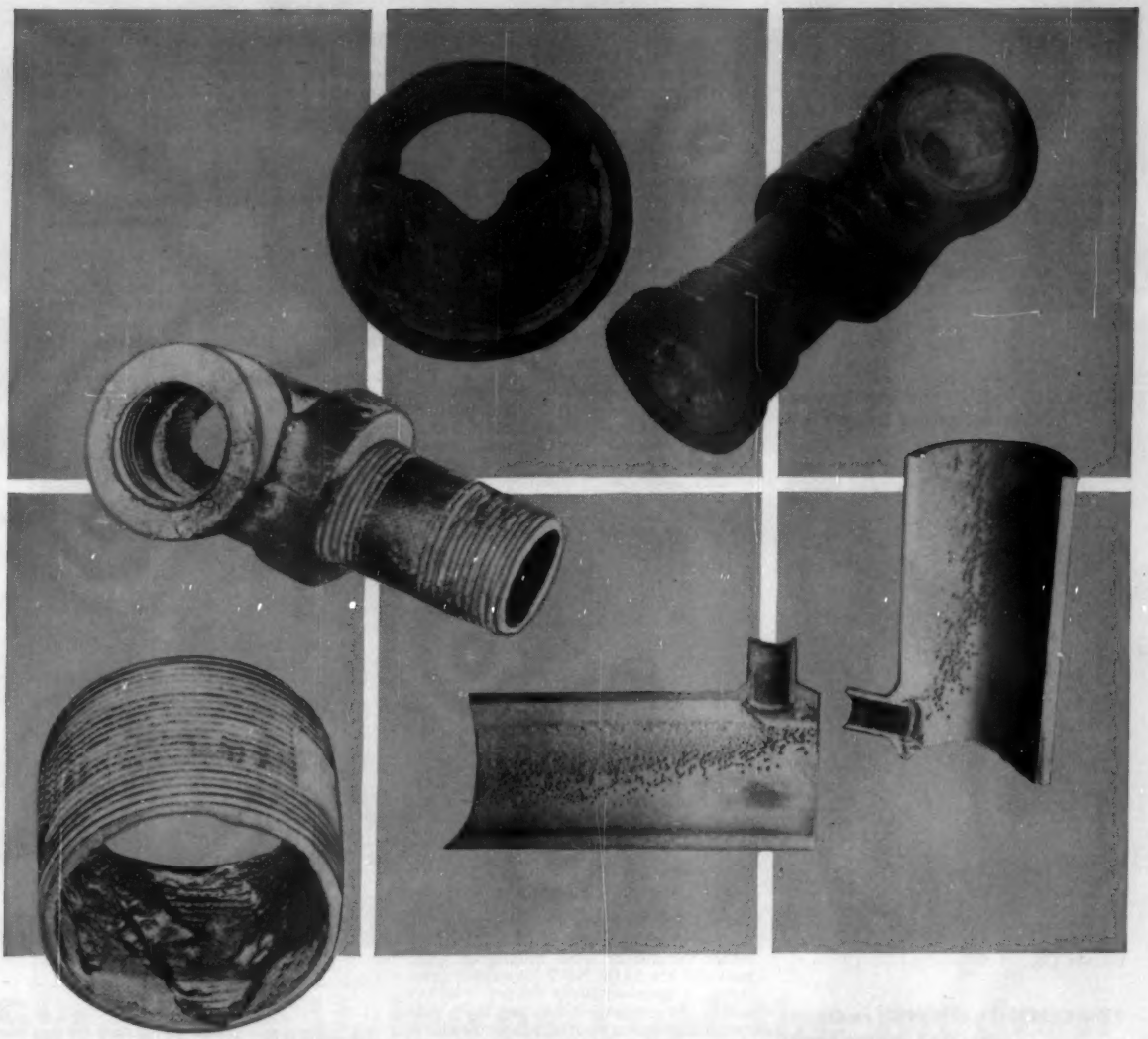
The Bal-lok, a ball-type non-reverse ratchet is designed to lock within 3/32 of a revolution and prevent the motor and pump from rotating in reverse. This ratchet, illustrated, is offered on manufacturer's vertical hollow-shaft electric motors in all sizes up to 200 hp. It is explained that the Bal-lok's ratchet element is always stationary, while the ball retainer rotates with the motor. When the motor rotates in the proper (counterclockwise) direction (1), centrifugal force



lifts the balls clear of the ratchet so they do not interfere with rotation. Once the motor stops (2) the balls drop back into the ratchet recesses. Should the motor begin to turn in the reverse (clockwise) direction, one or more balls will lock in the ratchet and prevent rotation, says company. The Bal-lok assembly is mounted at the top of the motor for easy installation and accessibility. ACEC Electric Corp.

15—OIL FILTERS permit selective filtration

These Multi-Cartridge Oil Filters are announced for a wide range of applications — engine lube and fuel oils, hydraulic oils, air filter oils — any opera-



WHAT'S YOUR TROUBLE?

Each of these destroyed parts had to be taken out of service because of incomplete or inadequate water treatment. Replacement meant loss of steam production . . . new equipment expense . . . added labor-repair costs.

DEARBORN COMPLETE WATER TREATMENT SERVICE eliminates this by providing trouble-free water—a vital necessity to every user of industrial steam. Dearborn's many years of leadership in the field of water treatment will help keep your power plant operating economically.

CALL ON YOUR DEARBORN SALES ENGINEER for (1) analysis of raw water (2) recommendation of test procedures (3) proper treatment (4) a manually or automatically controlled feeding system.

Dearborn®

combatting corrosion wherever it occurs

Dearborn Chemical Company
Merchandise Mart Plaza, Dept. PG
Chicago 54, Ill.

Please send me
☐ Bulletin 5000 ☐ Bulletin 5013 ☐ Have a Dearborn Sales Engineer call.
☐ Bulletin 5008

Name.....
Company.....
Position.....
Address.....
City.....*Zone*.....*State*.....

For more data circle 527 on Post Card

tion where oil can be by-passed. Six different cartridge refills may be used interchangeably, each designed for a specialized filtering job depending on type of oil, flow rate required, kind and degree of contamination, other variable factors.

Filter is available in ten sizes using one to 24 cartridges. It is suitable for individual machines, central systems, or batch filtration, with choice of electric, steam or hot water heat. All models feature quick opening covers for convenience in changing cartridges, and large models have a lifting device that raises and swings cover to one side. Bulletin 201 gives full details. Filtration Div., Houdaille-Hershey of Indiana, Inc.

16—PLUG VALVE for use in refineries, allied industries

The 9195 Plug Valve is announced as especially designed for use in petroleum refineries and allied industries where liquid fuel is burned at high tempera-

tures (up to 700 F.) as in vacuum still towers, asphalt plants and other uses. All parts of these valves are machined from solid ingots. Body is steel and trim is stainless steel. They are available in sizes of ⅜, ½, ¾ in. National Airoil Burner Co.

17—CEMENT LINING restores corroded water tanks

Large water storage heaters and steel tanks that are rusting away on the inside can be restored to operating condition with C-17 Pre-Krete, it is announced — and at about $\frac{1}{10}$ the cost of a new tank. C-17 Pre-Krete is described as a specially blended cement formula that will not shrink or crack and is not subject to high temperature failures. It is mixed with water to the consistency of a paste and applied to a dried and cleaned tank surface (company says it may be applied directly over rusted areas). It is troweled on about ½ in. thick. When this lining has set, a little water is placed in the tank and the manhole closed. In such a moisture-laden atmosphere, C-17 Pre-Krete cures in 24 hr, it is reported; in open-type vessels the lining is periodically hosed with water to aid curing. Pocono Fabricators, Inc., Div., The Patterson-Kelley Co., Inc.

18—VOLTAGE REGULATOR incorporates reversing switch

A reversing switch on the line-drop compensator is now a standard control feature on this company's single-phase step voltage regulators. It allows selection of a positive or negative value of resistance or reactance, it is announced, giving the exact amount of line-drop compensation required. This control uses no auxiliary relay, manufacturer notes, eliminating erratic operation of the voltage relay due to possible chattering of the auxiliary relay. As an aid to linemen making connections during installation, bushings on these regulators are quickly identified by letters on tank cover, indicating their function. Locking knobs to prevent accidental turning of correctly-adjusted dial controls are provided on the control panels of all feeder voltage regulators. General Electric Co.

19—MULTIPLE BRANCH TEE solves header problems

This multiple branch tee with integral extruded outlets is said to make possible a sound and economical solution to many header problems in the chemical, power and petroleum industries, and to be advantageous in the fabrication of piping for air conditioning and radiant heating systems.

A recent change in the Code for Pressure Piping, Section 8, requires the use of welding tees or full encirclement reinforcement, for the larger diameter openings and working pressure developing hoop stresses exceeding 50 per cent of the yield strength of the run pipe, it is explained. This multiple branch tee is designed to conform to the Code's area replacement formula. It is declared especially useful where branch outlets are appreciably smaller than the run pipe. The product is "tailored" to individual jobs — size, wall thickness and number and size of outlets being determined by service conditions. It is available in commercial metals and alloys. Tube Turns.

20—AIR SWITCHES divert and reduce pressures

These pneumatic switches are announced as small, simply designed, and suited for either surface or flush mounting. Connections are ⅛ in. NPT for supply pressures to approximately 25 psi. Positive acting diverting switches are built with two, three or four ports. Many functions are possible with various piping arrangements, it is noted, and several standard engraved dials can be furnished. Bulletin 357 gives more details. The Powers Regulator Co.

21—BALL BEARING UNIT is two-bolt flange type

Interchangeable with the four-bolt flange units in this company's Sealmaster line, this new bearing also incorporates the same design features including "zone hardening" and labyrinth seal. It is available in shaft sizes from ½ to $2\frac{3}{16}$ in.

On new installations, the two-bolt flange bearing eliminates two fasteners, as well as the punching or drilling of two mounting holes. Also, it cuts installation costs and permits closer bearing spacing on multiple shaft installations. As a replacement bearing, this new Sealmaster unit fits the diagonal bolt centers on present four-bolt base flange units and carries the same load rating for a given size. Bulletin SS-125 gives further information. Stephens-Adamson Mfg. Co.

22—VIBRATING SCREEN with lower silhouette

Straightline horizontal vibrating screen is reported to be especially suited for dewatering high capacity loads and sizing of material where headroom is limited. It has a much lower silhouette, manufacturer notes, although all advantages of high-intensity straightline action are retained. The screen has two vibrators, one mounted on each side at deck

level for ease of inspection. Both are located at the center of gravity, it is noted, so that uniform vibration is assured. They do not project above the sideplates; thus headroom is held to a minimum. Available in sizes from 4 by 8 ft to 6 by 20 ft with either one or two decks. Data Sheet 2562 gives more details. Link-Belt Co.

Reader Service Cards on pages 97–98 make it easy to get further information on any of these products. Just circle the item numbers of the products you want to know more about.

23—TRANSMISSION SYSTEM utilizing two-wire circuit

The Orthoflow is designed for installation where accurate transmission of flow or other measurable data is required over distances and it is not possible to obtain data through mechanical measuring devices. It can be adapted to transmit data over private wires in in-plant services or, with the addition of a few simple parts, for use over leased telephone channels where data may be transmitted over many miles.

The system may be applied for transmission of flow, liquid level, or pressure measurement, manufacturer announces, and can be adapted for installation in critical locations where explosion-proof characteristics may be required. The transmitting units may be applied to mercury cylinders of varying sizes to produce measurements over 4 to 1 to 20 to 1 ratios. Accuracy of the system is given as within ± 2 per cent. Simplex Valve & Meter Co.

24—CIRCUIT BREAKER consists of two pole units

Type TQL common trip circuit breaker consists of two pole units with an interlocking trip mechanism assembled as a

Syracuse U. burns coal the modern way for dependable steam supply

Over the past decade, there has been a growing demand on the steam plant at Syracuse University. Not only has the university itself expanded rapidly, but six hospitals on or adjacent to the campus depend on university facilities for steam. When the original steam plant proved inadequate (total output 190,000 lbs. per hr.), the university built a completely up-to-date unit to replace it.

The internal operation of this new plant is as modern as its panel and glass exterior. An automatic handling system delivers the coal from hopper to bunker to pulverizer to boiler. A pneumatic-type integral combustion control system operates the boilers automatically. A pneumatic disposal system removes fly ash and cinder ash automatically. Today Syracuse University is assured an adequate steam supply—capacity 300,000 lbs. per hr.—and a clean, economical operation in the process.

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Why not talk to a consulting engineer or your nearest coal distributor? Their advice may save you thousands of dollars each year.

facts you should know about coal

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.

Automatic coal and ash handling systems can result in a virtually labor-free plant.

Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.

In most industrial areas, bituminous coal is the lowest-cost fuel available.

Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D.C.

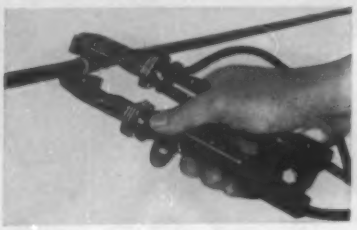
For more data circle 528 on Post Card

single unit. It will fit load centers or panelboards designed to take company's 1-in. Type R or Type TQL circuit breakers. The breaker is available in six ratings from 10 to 50 amp for 120/240-v a-c operation. It has an interrupting rating of 5000-amp a-c.

Excessive current in either pole trips both poles simultaneously; this, it is noted, greatly reduces risk of accidental shock. Thermal and independent magnetic trip elements provide protection against both short circuits and sustained harmful overloads. Momentary overloads, such as those caused by motor starting, will not trip the breaker, it is stated. The TQL is trip-free — that is, it will trip out even if the handle is held in against a circuit fault. The unit is easy to install, manufacturer points out, because of its plug-in construction and straight-in wiring for terminal connections. And the single-unit enclosure for both poles eliminates need of handle ties on separate single-pole breakers. General Electric Co.

25—SOLDERING SET is fast and easy to use

Designed for soldering copper tubing, the 10554 Plumbers' Portable Soldering Set, consisting of an all-electric pliers soldering device and a 1000-w portable power unit, is announced as safe and easy to use. There is no open flame, burn or fire hazard. It operates from the nearest power outlet, manufacturer points out, and is fast to rig and start work. Although designed primarily for solder-



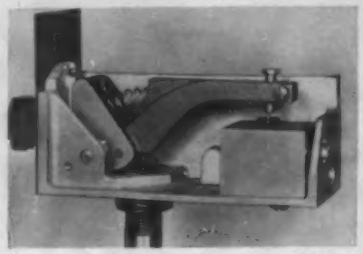
ing copper tubing "sweat" fittings up to 1¼ in. in size, it also works on heavy electrical wire and cable, such as in motor repair and power line work, other heavy soldering jobs. It is portable, has a pocket in the case for pliers and leads, push-button heat control in the pliers' handle, and ten-foot leads. Manufacturer says it will solder ½-in. OD tubing fittings reliably liquid tight in about 20 sec. Bulletin 105H gives more details. Wasco Electric Products Corp.

26—GEAR REDUCER can be adapted to various motors

The G-8 Gear Reducer, which can be adapted to any of company's motors, is designed to fill the need for a universal gear motor with a parallel output shaft. This unit is available in any voltage up to 250, and in speeds as low as 1 rpm. It is designed to meet loads to 15 in.-lb. The motor can also be built with an electric governor speed control and can be rheostat controlled, dynamically or mechanically braked. RAE Motor Corp.

27—TEMPERATURE CONTROL for pneumatic systems to 50 psig

The Model DA is designed for use on installations where temperature is to be controlled by varying the flow of gas, steam, or other medium with an air-operated valve or motor. It may be used in any pneumatic system up to 50 psig and will reduce the output or branch line



pressure as temperature increases. Since it operates by the differential expansion of solids and uses no liquid or vapor fill, it is available for temperatures as high as 1800 F.

Temperature adjustments are made with knob on front of case. Throttling ranges are fixed, but may be as narrow as 5 deg or as wide as 100 deg. Control is obtained by the difference in expansion of two concentric tubes actuating a pilot valve through a lever. Bulletin 151 gives complete information on the Model DA. Burling Instrument Co.

28—SUBMERSIBLE MOTOR of wet type construction

Designed for water well pumping, this submersible motor is announced as having "wet" type construction in which entrance of water into motor will cause no harm to windings. A special process is used to encase copper windings in a plastic armor impervious to water. Motor is claimed immune to leaky joints, wear of seals, condensation, impurities, vibration.

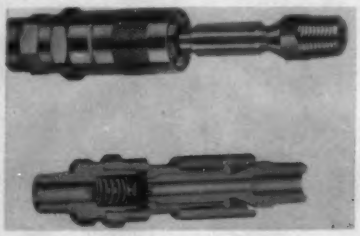
To guard against internal corrosion, motor is factory filled with a highly stable emulsion of oil and water. Weight of rotating parts and pump thrust is supported by a thrust bearing of the tilting shoe type, and radial bearings are of the hard babbitt sleeve type which contact the stainless steel motor shaft. Because of the water/oil emulsion, there is no need to lubricate motor at any time, it is pointed out. A control box with heavy enclosure and hinged lid is provided, containing starting capacitor, relay, overload device, motor data, wiring diagram and connection terminals. The motor comes in ratings from ½ to 2 hp, single phase, and 1½ and 3 hp, three phase. Bulletin F-1870 gives full details. U. S. Electrical Motors Inc.

29—SUBMERSIBLE PUMPS meet freshwater supply needs

Especially designed for industrial and commercial service, the high-capacity Sumo Series C line of submersible pumps is said to meet freshwater supply requirements for general plant facilities as well as such auxiliary services as fire fighting, air conditioning and cooling, processing. Pumps come in capacities to 200 gpm and operate at dynamic heads up to 450 ft in 6- and 8-in. diam wells. Construction consists of a direct, close-coupled centrifugal pump and motor unit. Pump and motor assembly is lowered down the well on end of discharge pipe and operates under water. The submersible type motor is available in ratings from 3 to 15 hp. The pumping unit, consisting of bronze centrifugal impellers operating in bronze pump bowls, can be supplied in from four to 12 stages. The pumps offer easy installation, it is said, as well as low running costs, high capacities and efficiencies for deep well installations, and compact size permits use in narrow wells. Sumo Pumps Inc.

30—COUPLING offers instant locking, unlocking

This improved coupling which utilizes a modified collet principle for instant locking and unlocking is announced as lightweight, smaller in diameter, with foolproof engagement even under adverse conditions. When engaged, coupling is free to swivel, yet, it is pointed out, has 80 per cent of plug shoulder in complete contact with collet fingers. The new design has been tested on pneumatic and fluid applications, manufacturer notes. It is available in single valve construction with many styles of threaded ends



and hose attachments. Double valve and straight thru couplers are also available. The collet principle of the coupling is also reported successful on vapor proof electrical connections, rod ends and flexible shaft use. R. S. Corcoran Co.

31—PLASTIC PACKING, resistant to acids, alkalis, solvents

Flexrock 403, a Teflon plastic packing, is claimed to make an outstanding emergency packing and to be particularly successful for centrifugal applications. It is composed of shredded Teflon combined with suitable binders and lubricants extruded into an open cotton yarn jacket impregnated with graphite. This packing is also available impregnated with mica for use in the food industry or wherever a non-contaminating packing is essential.

Possessing the qualities of Teflon, this packing is chemically inert, manufacturer points out, and will not be attacked by organic or inorganic acids, alkalis, or solvents. It is declared serviceable from −150 to 550 F and suited for all packing applications (dynamic or static) that require the chemical resistance of Teflon. The packing is easily installed by cutting it to length, coiling around shaft, and placing it into stuffing box. It is available in ¼ to ¾ in. sizes in increments of 1/16 in. Packing Div., Flexrock Co.

32—MOTOR CONTROL designed to save floor space

Limitamp high-voltage motor control is reported to save more than 50 per cent in floor space over previous models. A high-voltage fused starter for coördinated control of motors up to 3000 hp on 2300- to 4800-v systems, Limitamp offers protection against circuit faults up

This

NEW BULLETIN

provides economical solutions to every industrial water treatment problem

ENGINEERS and consultants helped prepare this new Bulletin No. 953 . . . "Controlled Volume Pumps for Water Treating Systems."

It has been termed, "a most important contribution to water treating literature."

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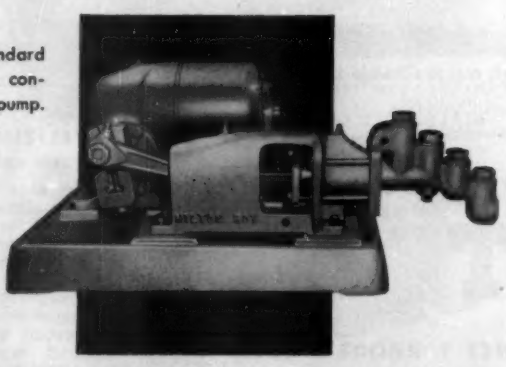
Milton Roy standard motor-driven controlled volume pump.



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to 60,000 amp, according to company engineers. Designed to provide maximum short circuit protection, fuses of high interrupting capacity limit current flowing in a fault within one-quarter of a cycle and interrupt within one-half of a cycle.

Units are only 30 in. deep, one-half that of previous models. Being all front-connected, enclosures can be mounted back-to-back or back-to-wall, and no back aisle is required. A low-voltage panel in middle compartment swings out and the high-voltage contactor in lower compartment rolls out, allowing personnel to stand inside to bring in incoming cable, connect power to the bus, motor lines to current transformers, and control circuit lines to control terminal board before contactor is rolled into place. Protection for personnel is provided with gang-operated disconnect switch, which isolates all components from incoming power. This is connected to an interference interlock, so that entrance to any high-voltage compartment is not possible until contactor is de-energized and disconnect switch is opened. The Limitamp Control is declared suitable for squirrel-cage, synchronous, wound-rotor, and multi-speed motors. General Electric Co.

33—GEAR PUMP with hand-operated control

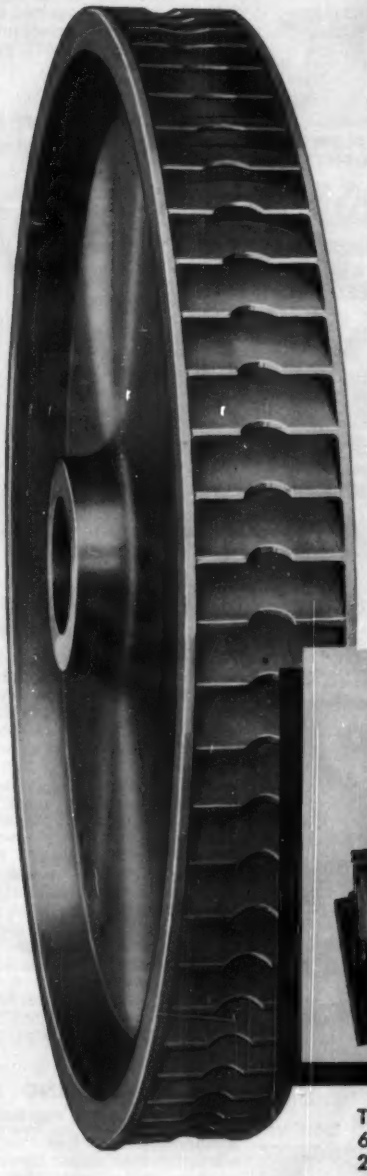
Variable Delivery Gear Pump Model FVI, it is announced, can be adjusted to deliver lubricant at any rate from 3½ to 10½ gph. Rate of flow can be controlled by hand while pump is in operation with a simple regulating screw, manufacturer notes, and positive delivery is accomplished without throttling. This is said to result in a constant and uniform delivery, even when lubricants of different grades of viscosity are used. Another advantage is that little heat is generated during operation. Designed for a rotary drive, pump is small and compact, measuring 2⅝ by 3⅛ by 3½ in. It is sturdily built and may be adjusted by hand or automatically in stages of 1½ gph. Model FVI is declared particularly desirable for hydraulic installations, oil burners, oil impregnating machines. Nathan Mfg. Corp.

Described on these pages are new and improved products. Use Reader Service Cards on pages 97–98 to ask for more information on them. Just circle the item numbers of all the products in which you are interested.

34—DEALKALIZING UNIT employs salt splitting method

This dealkalizer uses the ion exchange principle of salt splitting as a means of reducing alkalinity in boiler feed and process water. The process substitutes chloride ions for bicarbonate, carbonate, sulphate and nitrate ions, it is announced, reducing water alkalinity over 90 per cent. Since no carbon dioxide is formed, no aeration of water is subsequently required, says company, and dealkalizing provides continuous water treatment under pressure. The new unit

TERRY SOLID-WHEEL *SIMPLICITY* MEANS *SUSTAINED* HP



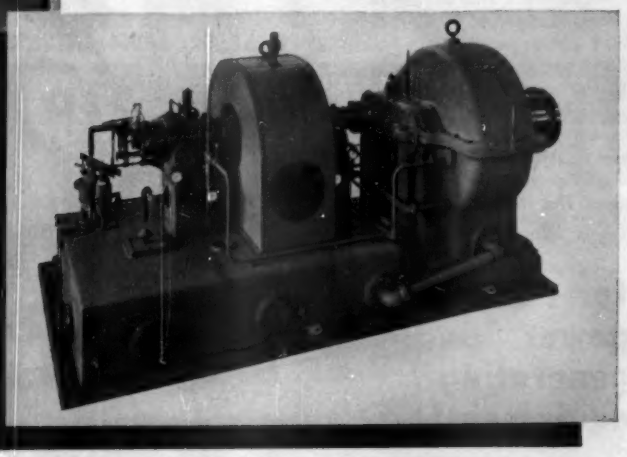
A Terry solid-wheel turbine is simplicity itself. Particularly the rotor. This is a single forging of special composition steel. And, unlike a built-up wheel, has no separate parts to loosen or work out.

Blade wear which might occur after years and years of usage is of little consequence, because the power-producing action of the steam takes place on the curved surfaces at the backs of the buckets. Thus wear does not materially affect horsepower or efficiency.

The blades can't foul. There is a one inch clearance on either side of the wheel and, in addition, the blades are double rim protected. There is no need for close axial blade clearance, because the steam enters the buckets at right angles to the shaft.

Perhaps you, too, can profit from Terry solid-wheel stamina. Bulletin S-116 gives complete details. Send for a copy today.

TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONNECTICUT

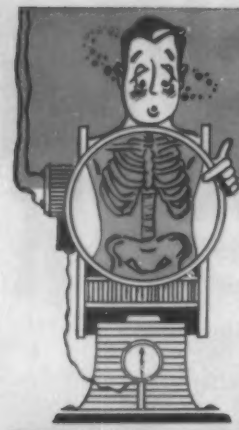


This Terry solid-wheel turbo-geared unit is rated 600 hp, 4000/650 rpm for 820 psi, 825°F steam with 275 psi back pressure.

TERRY

TT-1201

For more data circle 531 on Post Card



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One of several styles used in leading plants.

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Control receipts and consumption of many liquids. Bunker C thru light distillates.

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PROTECT FUEL INJECTORS WITH A GOOD FILTER

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A Bowser system keeps turbine oils dry and clear. Stops bearing failures. Oil lasts longer. The best insurance for power plants.

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uses a strong basic anion resin which is regenerated with either sodium chloride or a mixture of sodium chloride and caustic soda. The process is semi-automatic with a single solo valve or hydromatic valve handling the regenerative cycle. Completely automatic cycling is possible by use of a meter on the effluent and a hydromatic valve, electrically operated. Available in a wide range of sizes, the unit is suggested for chemical plants, textile mills, medium size power plants. Publication 4567 gives further data. Cochrane Corp.

35—SAFETY SOLVENT for cleaning electrical equipment

Improved Turco-Solv is claimed to be non-explosive and non-flammable and to combine the least toxic of solvents. It is reported to offer the greatest possible solvency for removal of grease, oil and carbon film from brush holders, insulators, commutators, string bands, commutator and armature coils. New Turco-Solv evaporates quickly, according to manufacturer, and since it is non-conductive, can be used to clean hot motors in place — often without disassembly. Company says it dries completely and without residue, and requires no after-neutralization. Although designed for cleaning of motors, generators, switches, control panels and other electrical equipment, this solvent is suited for other cleaning jobs incident to plant maintenance. A folder, "How's Your Health," evaluates methods of solvent cleaning. Turco Products, Inc.

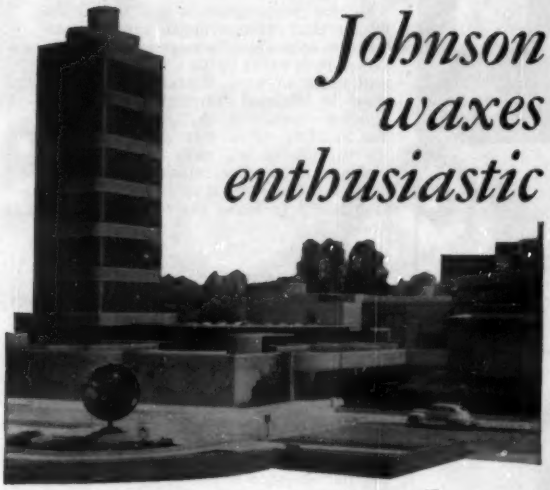
36—MASTIC COATING requires only one spray coat

Amercoat 87 can be applied at a thickness of 10 mils in one double-pass spray coat, company reports, and the vinyl mastic produces its heavy film thickness without sacrificing the chemical and moisture resistance for which vinyls are known. Despite its high solids content, the coating is applied with conventional industrial spray equipment. The dense, highly impermeable protective film does not flow away from the edges and sharp corners, it is pointed out, and therefore provides extra protection for areas particularly susceptible to corrosive attack. These new properties are attributed to an increased vinyl resin content made possible by new combinations of solvents. Manufacturer says the coating has a non-volatile content in excess of 55 per cent — nearly twice that of many vinyl maintenance coatings. Amercoat Corp.

37—REFRIGERATING UNITS for large capacity cooling

Absorption refrigerating machines which have no major moving parts and produce chilled water from hot steam are announced for large capacity air conditioning and process cooling installations in 11 sizes from 100 to 700 tons. These machines adjust automatically from full to virtually zero load with little loss in efficiency, says manufacturer, and are designed to produce low-cost cooling wherever an economical source of heat, such as natural gas, is available. They are also suitable when a source of steam is already available from the heating boiler, as a by-product of a process using steam, or from district steam lines.

Since the machine operates on low



Johnson waxes enthusiastic about GUSTIN gb BACON SNAP*ON

In the strikingly modern plant of the Johnson Wax Company in Racine, Wisconsin, molten wax flows through an extensive maze of piping. Steam tracers coil about the piping to keep these waxes fluid, and of course, insulation is a "must".

To insulate this piping, the Johnson Company selected lightweight G-B Snap*On, the one-piece molded pipe insulation of fine glass fibers. The fact that Snap*On is reusable was important to the company, since piping is frequently changed around to accommodate new processes. Johnson people were equally pleased with the ease of application and the snug fit of Snap*On over steam traced lines. And Snap*On's thermal efficiency — highest of any pipe insulation on the market — was still another deciding factor.

Because it is an all-purpose pipe insulation, Snap*On, with a vapor barrier jacket, was also selected to insulate chilled water lines in the Johnson plant. Snap*On is available in a wide range of pipe sizes up to 33", in a variety of wall thicknesses and jackets. If you, too, are looking for a new and better way to insulate cold or heated piping where temperatures do not exceed 350° F, write for the full story, on Snap*On . . . today!

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe coverings and fittings • Molded glass fiber pipe insulation

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TO DEAERATE
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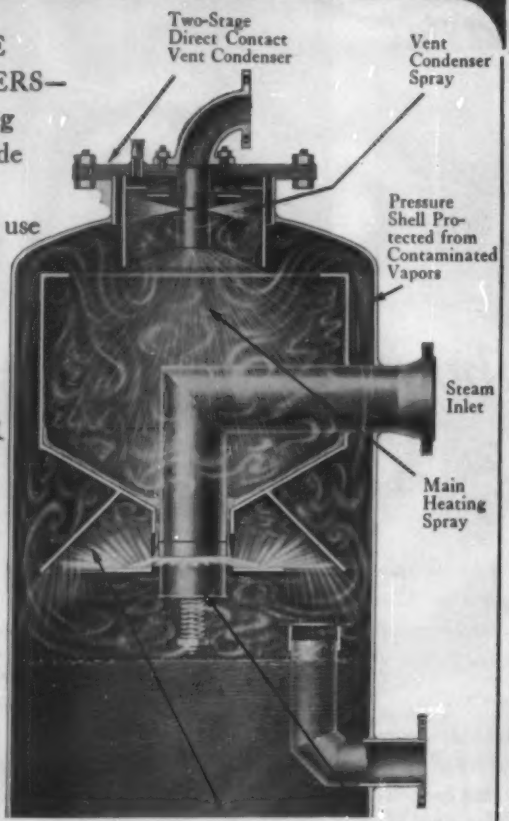
SPRAY
DEAERATOR
is ideal



Its two-stage counterflow construction uses clean entering steam for final deaeration. It performs at low loads as well as at high. There is no slam or hammer, no counterweight. May be had with direct contact vent condenser (as shown) or with external surface vent condenser.

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SERVICE SINCE 1902 TO THE INDUSTRY

AMERICAN *Water Softener* COMPANY
INCORPORATED
PHILADELPHIA 33, PENNSYLVANIA

pressure steam, which may be obtained from back pressure turbines or exhausted from processing operations, it can provide chilled water for summer air conditioning or process chilling at little operating cost, it is pointed out. Due to its light weight and lack of moving parts the machine can be installed on roofs without special reinforcing, says company, and its vertical assembly occupies a minimum of floor space, which facilitates installation at intermediate floor levels or in the basement. It is also claimed silent in operation. Carrier Corp.

38—WIRE STRIPPER is improved, hand-type tool

The new Stripmaster is said to feature 60 per cent more strength through new I-beam type handles, greater holding power in jaws. It strips a variety of sizes and types of wire. Faster, easier stripping is claimed through the single-squeeze operation. A light squeeze of the handles strips wire clean and bare up to full ¾ in., says manufacturer. Release the handles, remove the stripped wire and the jaws snap back into position ready to make the next cut. Ideal Industries.

39—PIPE INSULATION for —120 to 250 F temperatures

Fiberglas White Dual Temperature Pipe insulation is reported to combine maximum insulating efficiency and condensation protection for lines operating at low temperatures or at alternating cycles of high and low temperatures. For temperatures from —120 to 250 F, this product includes a factory-applied vapor barrier designed to prevent condensation and provide an attractive white, slightly crinkled surface. The insulation is made of fibrous glass bonded with a thermosetting binder and the jacket is a five-ply laminate including an asphalted Kraft paper for the inner surface, a bleached Kraft paper for the outer surface, the two enclosing a 0.001-in. thickness of aluminum foil.

This jacket, company points out, has a vapor transmission rating less than 0.01 perms, which helps prevent condensation on piping. The insulation fits standard sizes of pipe to 33 in. and copper tubing to 6-in. For pipe sizes up to 12-in. diam. the insulation is furnished in hemi-cylinders, with the vapor barrier attached. For larger pipes, it is supplied in three segments to 28 in., and in seven segments to 33 in., and the jacket is applied separately. The insulation comes in four nominal thicknesses of 1 to 2½ in., is fastened in place with metal bands. Owens-Corning Fiberglas Corp.

40—TAR BASE COATING for protecting asphalt surfaces

Tarcote is announced as a tar-base coating for asphalt surfaces which checks the destructive effects of frost action, actinic rays of the sun, oxidation, acids, salts, alkalies, and petroleum products. Tarcote is applied cold, with brush, squeegee or heavy duty spraying equipment. It contains no solvents or toxic ingredients, manufacturer points out, and can be applied directly from the container with no additives or mixing required. It is suggested as a protective coating for parking lots, driveways, runways, platforms and similar black-top areas. Bitucote Products Co.

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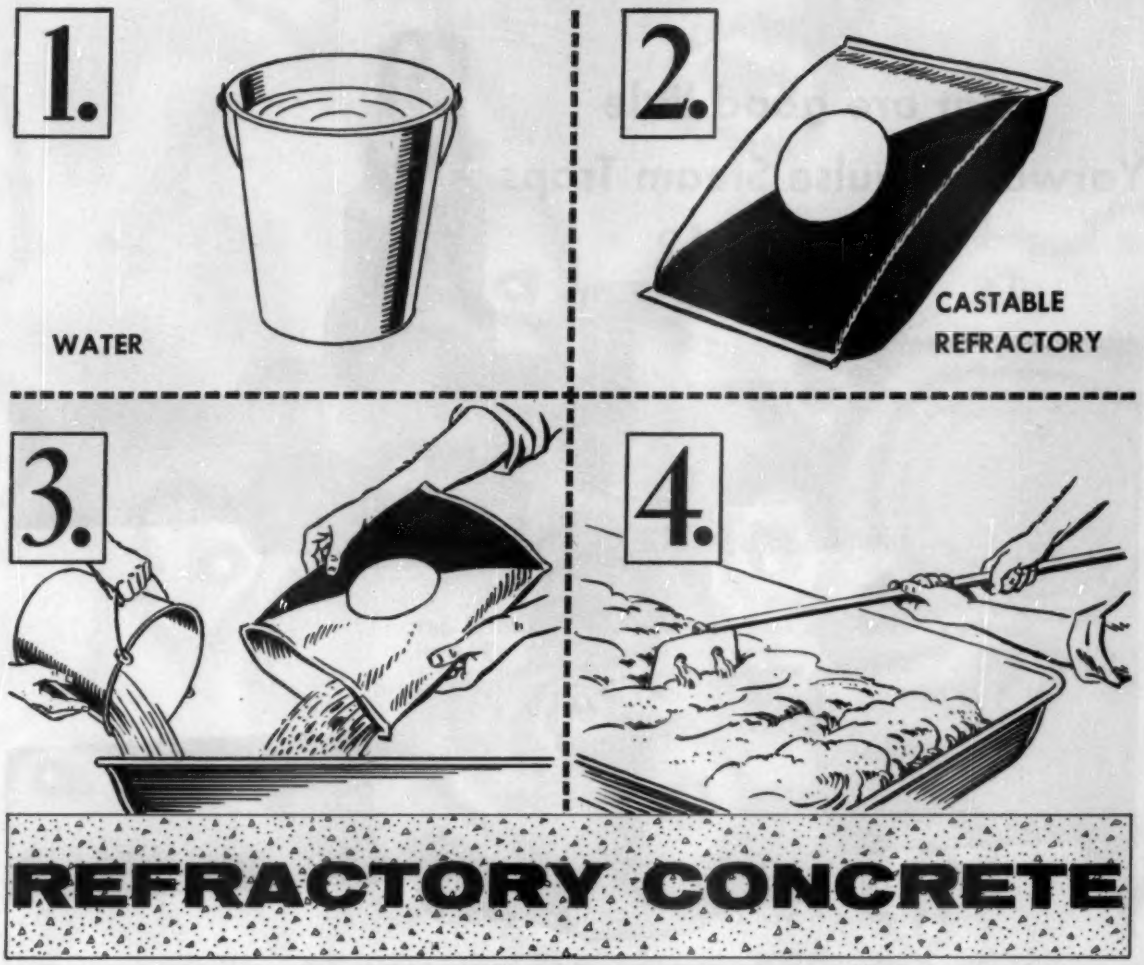

is easy to make with a Castable Refractory

Just add water to a packaged castable, mix, and you're ready to place refractory concrete. Castable refractories supply you with the right combination of selected aggregates and Lumnite* calcium-aluminate cement carefully proportioned to meet the heat resistance and insulation requirements of many jobs.

Chances are this convenient way to make Refractory Concrete can speed work and cut costs on your next refractory job. Why not keep a few bags on hand—you'll have "two strikes" on your next emergency repair! Castables are made and distributed by manufacturers of refractories.

Refractory concrete made with castables is the *adaptable* refractory—can be easily placed in any size or shape . . . resists severe thermal shock and spalling. It can be poured, troweled or "shot" on by cement gun, and it's ready for service in 24 hours or less.

For additional information, write Lumnite Division, Universal Atlas Cement Company, (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y. or contact any of the offices shown below.

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PE-L-94

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what are good little Yarway Impulse Steam Traps made of?

STAINLESS STEEL, *of course*

Body and all internal parts of YARWAY Impulse Steam Traps are of *stainless steel*—one of the biggest steps taken by any trap manufacturer to increase trap life and reduce maintenance.

Other YARWAY Impulse Steam Trap features:

- **Gets equipment hot in a hurry—and keeps it hot.**
- **Good for all pressures without change of valve or seat.**
- **Easy installation—small size, light weight.**
- **Non-freezing at low temperatures.**
- **Six standard sizes, ½" to 2".**

Want *proof* of performance? Try a YARWAY Impulse Trap and Fine Screen Strainer FREE for 90 days in your own plant. For free trial or free Trap Selector, write . . .

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So—You're Going to Overhaul Your Turbine Generator!

This is the fourth article in a series describing the scheduled overhaul of a 25,000 kw turbine generator at U. S. Steel Corp.'s South Works in Chicago. A list of past and future articles is given below. When all the articles have been published we plan to reprint the whole series. To reserve a copy of the reprint write to the Editor

IV. TURNING TURBINE COVER

When the cover is lifted off the turbine it is open side down. For work during the overhaul it has to be set down open side up. Here's how it is turned over

Fig. 1. Cover immediately after removal from turbine. Note open side is down. Now it has to be turned over into position shown in Fig. 11

I. Preview of whole series. II. Planning . . . Preparation . . . Preliminary work. III. Removing turbine cover and spindle. IV. Turning turbine cover. V. Reblading. VI. Metallizing eroded shaft. VII. Work on generator. VIII. Machining turbine spindle. IX. Checking clearances. X. Re-aligning turbine spindle. XI. Balancing. XII. Miscellaneous work. XIII. Safety and time-saving ideas

IV. TURNING TURBINE COVER

Fig. 2. Left. Cover is lowered on blocking and tilted slightly to let studs on h-p end clear floor. Two 1½ in. slings were then attached to the h-p end by clevises through stud holes

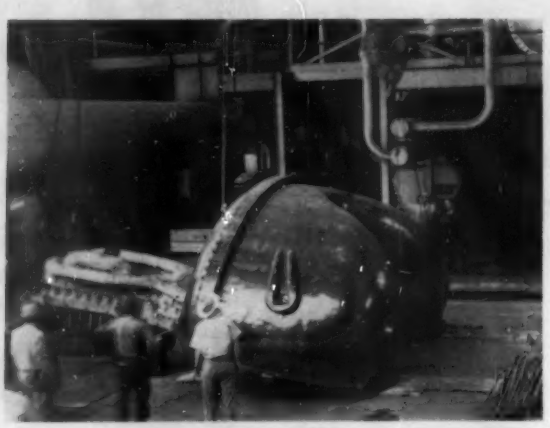


Fig. 3. Right. To prevent the l-p end slipping while cover is being lifted by its h-p end, a light restraining sling is attached to the l-p end of the cover. This sling is controlled by an auxiliary hoist on main crane

Fig. 4. Left. Start of lift. Cover is being raised by large sling attached to clevises at h-p end. Restraining tackle prevents the l-p end of cover slipping along floor as h-p end rises

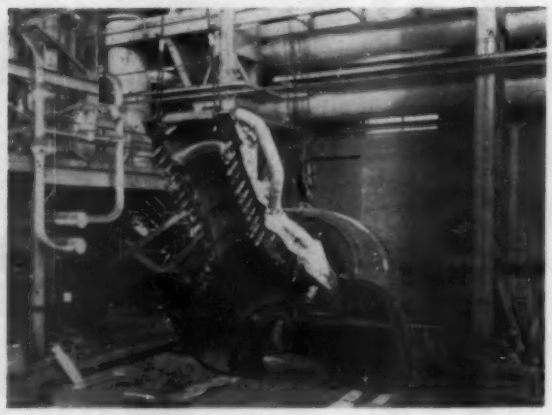


Fig. 5. Right. Still lifting. Main and auxiliary hoists are on same crane controlled by one operator. Method is to raise h-p end a little, stop, pay out restrainer, stop, then repeat till cover is in vertical position shown in Fig. 7

Fig. 6. Left. Cover near top of lift. Everyone stands clear to avoid swing of l-p end as it is lifted clear of floor. Restrainer has no steadying effect when cover is in a vertical position

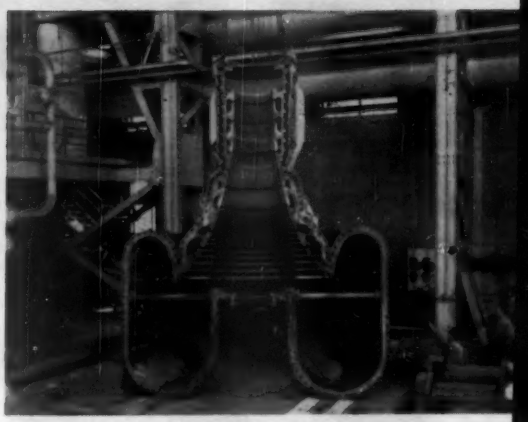


Fig. 7. Right. Cover at top of lift with l-p end just clear of ground. Restraining sling is now removed so cover can be rotated through 180 deg before lowering operation starts

Fig. 8. Left. Cover suspended entirely from h-p end, being turned through 180 deg about its vertical axis. Note hoist used for restraining sling hangs free. When cover has been rotated, restraining sling is replaced

Fig. 9. Right. Cover now facing in opposite direction, is lowered. Procedure follows same pattern as lift, with both main and auxiliary hoists working together to prevent slip

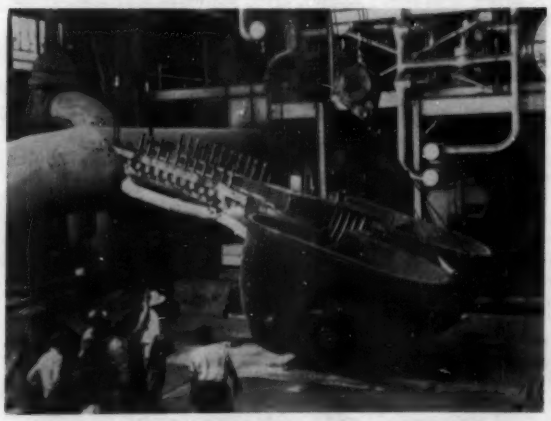


Fig. 10. Left. Still lowering. This photograph shows clearly the action of the restraining sling. Note how sling is attached to the cover by being passed through the two inspection holes in the l-p end of the cover

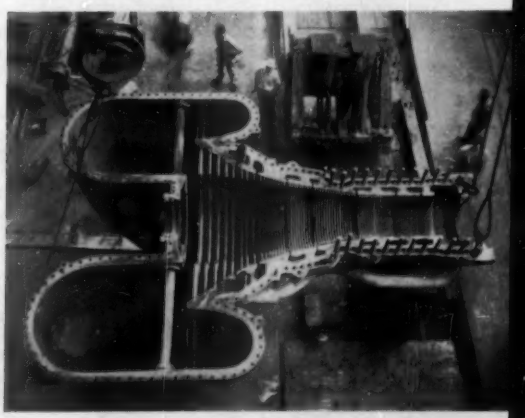


Fig. 11. Right. Cover ready for work platform to be built around it. When overhaul is finished and cover is ready to be replaced on turbine, same method is used to turn it over

Make It Safe With Standard Color Code

In recent years we have learned a lot about the effect of color on human behavior. Here the author, one of America's leading authorities on the use of color in industry, explains how this knowledge is used to reduce industrial accidents

By FABER BIRREN*

Industrial Color Consultant

UP TO WORLD WAR II the average American industrial plant had inadequate illumination, virtually no color, and its use of color for safety purposes was more or less haphazard. The old tradition of red as a symbol of danger was applied in some few instances (a poor choice inasmuch as about 10 per cent of male industrial workers are color blind).

During 1942–1943 the writer made a study of existing practices and standards in the use of color for safety purposes and worked out a coördinated code. This was announced at a meeting of the National Safety Council in 1943, and the code was published by Du Pont in 1944.

In 1945, at the request of the United States Government, the code was proposed for national acceptance by the American Standards Association. Only part of it was taken, however. Later, in 1953, the American Standards Association adopted substantially all of its original provisions. Meanwhile it had been put into widespread use by private industries throughout the country, by the U. S. Navy (in 1948, as mandatory safety practice), and by the U. S. Coast Guard.

Features of the Code

The Birren-DuPont Color Code for Safety recognizes six colors and six accompanying symbols (plus black, white, gray for miscellaneous traffic control, aisle marking and the like). To take into consideration the high percentage of color blindness among male workers (10 per cent) careful attention was paid to a selection of hues not likely to be confused. Red, for example, the former danger symbol, was largely abandoned and reserved exclusively for the identification of fire protection equipment. (Many laws in the United States require this use of red.)

The purpose of the code is to use brilliant color where (and only where) hazards are involved. In the painting of an industrial plant, all frills and decorations are avoided. With soft, functional colors on walls and on machinery, and with dangers clearly marked in gaudy hues, order is established — and any distraction of color has significant meaning.

High-Visibility Yellow (black and yellow striped symbol). Yellow is the color of highest visibility in the spectrum. Because of its great brightness it also is distinguishable under dim light. It is used for strike-against, stumbling, falling, tripping hazards. By itself, or with alternate black stripes, it is applied to guard railings, transportation equipment (shop mules, lift trucks, etc.), pit and platform edges, curbings, obstructions, dead-ends, low beams, barricades used in construction or repair, bumper plates on transportation equipment, beams on jib and wall cranes, crane hooks, crane cabs (for quick location from a distance), loading buckets, floor pan edges, floor and stair risers and elevation changes, ladders, movable platforms and stands.

In the U. S. Navy, yellow is standard for service, maintenance and ground control equipment on aircraft landing areas. In the form of a black and yellow checkerboard it is employed to mark areas designated as eye-hazardous, being placed on signs, screens, on doors and door jambs to caution against the hazards of sparks, flash burns, flying particles, acid.

Despite convention, it is good practice (also recognized by the U. S. Navy) to use High-Visibility Yellow for containers of flammable liquids, kerosene, gasoline, naphtha, alcohol, solvents, and to mark such containers with conspicuous letters in black describing their contents. Obviously, red on any containers or buckets should refer to fire protection, not to things flammable.

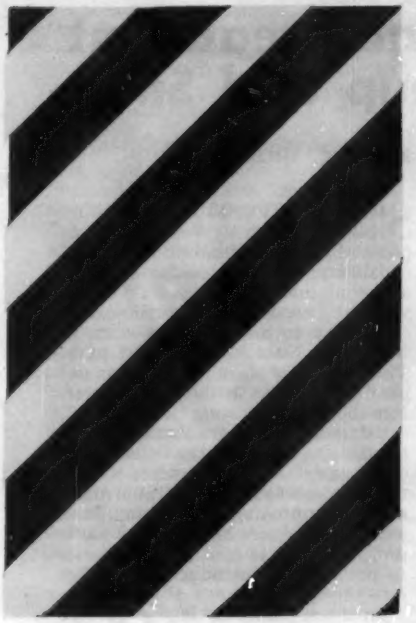
Alert Orange (symbolized by triangle). Here is one of the most vivid of colors and high in attention-value. It is used to mark hazards likely to cut, crush, burn or shock the worker. While color should never be used as a substitute for proper guards, Alert Orange is requisite where hazards are exposed.

This color is painted near or on gears, belt wheels and pulleys, along cutting edges, rollers, presses, the hazardous parts of saws, shears, brakes, planers, riveting machines, calenders, forming and punching presses.

Where parts are covered, the *insides* of guarding plates and lids and the exposed wheels or gears (if practical) should also be orange so that attention will be called to the temporary condition of the machine — or to negligent practice.

Alert Orange is likewise specified for guards or railings near hot pipes. As to electrical hazards, it is used to indicate exposed wires, overhead electric rails. It is painted on the *inside*

***This article is condensed from a portion of a talk delivered for the U. S. Department of State at the First World Congress on the Prevention of Occupational Accidents, Rome, Italy, April 2–6, 1955. Future issue will carry discussion of color economics by the same author.**



areas of switch box doors so that such doors will be kept closed.

In the U. S. Navy, Alert Orange is at times used on the *emergency* controls of large equipment, such as giant presses, so that these cut-off points may be readily spotted. (Otherwise the exteriors of switch control boxes are Precaution Blue.)

In studies of the detectability of colors in sea and air rescue, Dean Farnsworth, through the Medical Research Laboratory of the U. S. Navy, has shown the marked superiority of red and red-orange colors over all others, including yellow. These findings have led to new standards in the coloring of floats, buoys, safety gear, rafts and recoverable equipment.

Fire Protection Red (symbolized by square). Red is reserved exclusively for fire protection — and nothing else. It is employed on hydrants, fire mains and risers, hose connections, post indicator valves, sprinkler lines (in industrial areas).

It is painted, where practical, on extinguishers, hose carts, fire trucks, fire blanket boxes, fire doors, alarm stations. Good standard practice requires the use of large areas of red back of extinguishers on walls or columns, on floors beneath fire-fighting equipment (to prevent obstruction) and as square symbols or bands on upper walls or columns to facilitate quick location of extinguishers from a distance.

The U. S. Navy uses lettered signs to relate type of extinguisher to kind of fire: soda acid or foam for wood, paper, rubbish fires; foam, carbon-dioxide or vaporizing liquid for flammable liquids and oils, electrical equipment, etc. The Navy also requires the use of red on fire trucks, rescue and crash trucks in aircraft landing areas.

Safety Green (symbolized by cross). Green is the identifying color or symbol for first aid. It is used on first-aid and medicine cabinets, doors leading to first-aid rooms and dispensaries, on stretcher boxes, cabinets for gas masks and respirators. To aid location of such equipment from a distance, large green crosses are painted high on walls or columns.

Safety Green is likewise used on safety showers and on floor areas under them.

Precaution Blue (symbolized by round disk). Blue is used in the American railroad industry to mark cars or equipment being loaded, unloaded or repaired. Safety regulations require that such cars shall not be moved except on authority of the man who put the blue sign in place.

With Precaution Blue, this type of practice is further extended in industry. The color is painted on electrical control panels and switch boxes located on machines, walls or columns, on welding generator boxes, electrical control cabinets for machinery, cranes, winches, etc. Being unobtrusive, it serves to classify such equipment and to act as a silent reminder to see that everything is clear before operation is attempted.

Precaution Blue is also used, in the form of large signs marked "Out of Service," "Do Not Operate," etc., and placed on machines cut down for repair, over elevator controls, on scaffolding, boilers, ovens, driers, tanks, vats, kilns, and wherever caution must be observed. Shop rule should demand that all equipment, so marked, shall not be used, run or operated until the man who put the sign in place is consulted and clearance thus granted.

Radiation Purple (symbolized by a purple propeller target on yellow). Here is new color symbolism to provide protection against exposure to nuclear radiation type hazards. Such radiation, associated with radioactive isotopes, radio-chemicals and fissionable materials, is invisible but may lead to severe injury.

The symbol is placed on doors and door frames leading to hazardous areas, on containers, chests, vaults, on labels which must be attached to door handles, locks and all receptacles. Because fire may involve additional dangers, fire-fighting personnel must be carefully trained.

Traffic White, Black, Gray (symbolized by lines or a star). These neutral colors are used for aisle markings, storage area lines, waste receptacles and other such limited purposes.

However, where hazards are involved, such as along the edges of platforms or pits or around dangerous machinery, the floor stripe should be High-Visibility Yellow.

It is good housekeeping practice to paint white areas under waste receptacles, in corners and along the edges of stairways to discourage littering.

For an extensive bibliography of available color standards, publications and color codes, write to the Editor, or use one of the prepaid postcards elsewhere in this issue. Just write COLOR CODE on the card and mail it to us.

A five-pointed star may be used above receptacles to aid location from a distance.

Other Safety Symbolism

In addition to the Birren-Du Pont Safety Color Code described above, there are other standardized practices related directly or indirectly to safety. The major ones are briefly listed herewith.

Piping Identification. A color code for industrial piping has been in existence since 1928. For the most part, however, color is being used less and less for this purpose, the chief reason being that the problem has become too complex due to the great variety of liquids and gasses found in modern plants.

In the U. S. Navy and Coast Guard the contents of pipes are generally marked with black or white titles and have arrows to indicate direction of flow. This excludes the use of red on fire mains, the use of yellow for flammable gas and gasoline lines, and the use of green for oxygen lines.

In the code of the American Standards Association (A13-1928) red is suggested for fire protection; yellow or orange for dangerous materials; green, white, black or gray for safe materials; blue for protective materials, purple for valuable materials. Combinations of the colors may also be considered and designed to answer the requirements of individual plants.

Compressed Gas Cylinders. All U. S. Government Services recognize a color code for compressed gas cylinders (MIL-STD-101). Yellow is used for flammable materials; brown for toxic and poisonous materials; blue for anesthetics and harmful materials; green for oxidizing materials; gray for physically dangerous materials; red for fire protection materials. Various color combinations involving some 40 or more gases are given in the code.

Gas Masks. The U. S. Department of Labor, Bureau of Labor Statistics, has published a color code for the identification of gas masks. White is used for low concentrations of acid gasses; black for low concentrations of organic vapors; green for ammonia gas; blue for carbon monoxide; yellow for concentrations of organic and acid fumes; brown for acid and organic vapors and ammonia; black and white for dust, smoke, mists in combination with the above gases; red for mixtures of the above gases in air.

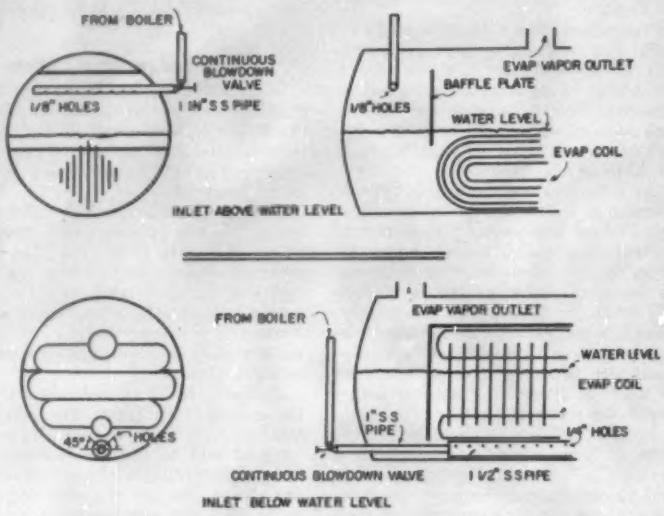
Evaporators Use Blowdown and Treatment to Reduce Makeup and Silica

If you supply makeup water with an evaporator, or plan to do so, this article is for you. It tells about tried and proved methods for decreasing evaporator loads while reducing silica to less than 0.02 ppm. Experience quoted was obtained in eight steam stations

By W. C. THOMPSON *

SILICA DEPOSITS on turbine blading are costly from the standpoint of loss in turbine efficiency and capability, turbine cleaning expense, and equipment outage time. To prevent such deposits in the turbine, it is customary to maintain the silica in the boiler steam less than 0.02 ppm. The amount of silica in the steam depends upon that in the boiler water. For boilers operating at 650 psi, satisfactory results are obtained when the dissolved silica in the boiler water does not exceed 3 ppm; while for 900 to 1450 psi boilers the desirable maximum is approximately 1 ppm. Such low limits require heavy boiler blowdown, as well as continued vigilance to prevent the introduction of silica into the system.

In steam plants having evaporated makeup a frequent point of entry of silica into the feedwater is the evaporator. The purpose of this article is to describe an effective method of silica control of the evaporator vapor. Our experience has concerned eight steam plants ranging from 650 to 1450 psi with a variety of waters and equipment.



Two methods of introducing continuous blowdown into evaporator are shown in these diagrams. Note that layouts avoid the direct impingement of blowdown entry jets on metals and that carryover is avoided by locating jets away from vapor outlets

Table of typical conditions encountered in evaporator silica control (5 plants)

Plant	A	B	C	D	E
Turbine, Pressure, psi	1,450	1,250	675	900	950
Temperature, F	1,000	950	825	900	900
Load, KW	90,000	45,000	14,500	67,000	25,000
Steam flow, lbs/hr.	860,000	365,000	140,000	630,000	190,000
Evaporator, Rating, lbs/hr.	14,000	10,000	3,000	12,000	6,000
Capacity to mid-glass, gals.	1,200	750	350	1,200	340
Water source	well	river	well	river	well
Pretreatment	hot lime	hot lime	hot lime	none	cold lime
Treatment:					
Magnesium chloride, oz.	60	32	12	60	0
Sodium hydroxide, oz.	8	0	2	20	40
Sodium aluminate, oz.	16	16	16	16	8
Makeup, gals. per run	12,000	2,500	2,500	8,000	1,200
Blr. BD, gals. per run	2,600	1,600	750	5,300	570
Boiler blowdown:					
Entrance to evaporator	top	bottom	top	bottom	top
Line, inches	1	3/4	3/4	1	1
Orifice, inches	3/8	3/8	1/2	3/8	1/4
Valves turns open	.35	.5	.2	.25	.5
Lbs. BD per hr.	3,200	1,200	300	1,920	1,200
Silica (ppm) Raw water	13.6	14.5	20.5	13.4	25.0
Precipitator	2.0	1.4	1.6	—	11.1
Evaporator shell	1.0	1.1	2.9	2.6	3.0
Evaporator vapor	.012	.019	.010	.016	.019
Boiler	.9	.6	2.8	.66	1.0
Evaporator Shell Water:					
pH (end of run)	12+	10.8	12+	11.5	11.3
Sodium hydroxide, NaOH, ppm	220	105	135	125	320
Hardness, $CaCO_3$, ppm	0	8	0	0	110

Early Treatment

In June 1950 we began adding magnesium chloride and sodium hydroxide to evaporator shell water. The theory was that the freshly precipitated magnesium hydroxide would absorb silica and thereby prevent its transfer, via the evaporator vapor, to the boiler feedwater. Sodium aluminate (Nalco #2), a good silica remover in its own right, was also added. This served to lower the silica content of the shell water still further by precipitation. By this treatment the silica content of the vapor was reduced from approximately 0.2 ppm to less than 0.02 ppm.

Even with this improvement, the amount of blowdown of high pressure boilers was excessive and it was difficult to keep the storage tanks filled with condensate. In November 1953, "to take the curse off" so much blowdown, the boiler continuous blowdown was diverted to the evaporator shell through a flow-control valve. It is fairly common marine practice to deliver boiler water blowdown to the evaporator shell in order to recover the heat involved, to take advantage of the softening power of boiler salts, and to reduce the amount of raw water to the evaporator; but in stationary power plants, this procedure is rather unusual. The present procedure has been used without

* Chemist, Northern States Power Company, Research Department.

evaporator pretreatment, and also following hot and cold lime precipitators. As a secondary treatment, the method serves to supplement and to even out the fluctuations of the primary treatment.

How Conditions Improved

Benefits obtained from the combination of magnesia treatment in the shell and the introduction of boiler blowdown to the evaporator are many. The following enumerated items summarize the improvement in operating conditions:

(1) Because boiler water with a silica content of 1 ppm replaces a portion of the raw water makeup (the silica content of raw water ranges between 10–25 ppm) the input of silica to the evaporator shell is materially reduced.

(2) The silica content of the evaporator vapor is decreased to approximately 1/20th of previous values, and consequently the required amount of boiler blowdown is much less than previously.

(3) There is a reduction of 20 to 50 per cent in the amount of raw water evaporator makeup. As a consequence, for a given maximum concentration of shell water, the total quantity of water evaporated between draining periods is increased.

(4) Evaporator scale is minimized to a point where frequent "cracking" is unnecessary.

(5) Alkaline conditions in the evaporator shell plus the fact that less bicarbonate makeup is required, results in less corrosive gas in the vapor and higher pH and resistance values in the condensate system. There is evidence to indicate that sulfides and ammonia are retained by the treated shell water.

(6) Sizable quantities of heat and soft boiler water are recovered. Most steam plant men hate to waste condensate or hot, phosphate-conditioned boiler water. The present procedure, therefore, might be referred to as "painless" silica removal.

(7) It has been unnecessary to remove silica from a turbine since we started this procedure. As turbine extraction pressures do not increase appreciably, maximum efficiency is maintained. Plant personnel favor the method as indicated by the following remark, "We have more water now than we know what to do with." This statement implies that it is no longer necessary to crowd the evaporator at high ratings, all of which is in the interest of better quality vapor.

As to the mechanical aspects of the introduction of boiler blowdown water into the evaporator shell, it would be advisable to consult the evaporator manufacturer. Some prefer to admit the continuous blowdown through a perforated distribution pipe running the length of the evaporator shell under the coil bundle, while others introduce it into a baffled section of the vapor chamber. We have used one-inch 1500 psi Hancock steel Flo-Control Weldvalves ($3/16$ in. orifice) to control the flow rate of the blowdown; also $3/4$ in. size with $5/32$ in. orifice. The discharge line from the valve and the distribution piping are stainless steel. The relief valve on the evaporator shell must be adequate to handle the maximum amount of vapor produced by the coil plus the flash steam that would be produced with the Hancock Flo-Control valve wide open. A high-level alarm is desirable.

In one of our early perforated distribution pipe installations the flashing jets of water eroded nearby support members. This was remedied by discharging vertically downward and installing a baffle plate to protect the affected supports. In one case, unsteady water in the glass and carryover were caused by too high a water level in the shell. Again, a six-inch band of scale formed along the front of one evaporator, the reoccurrence of which was prevented by a baffle. Generally speaking, there is no scale, no impingement and no corrosion. Evaporator tubes are 80–20 cupro nickel and arsenical copper. In some stations two boilers are blown down to the same evaporator alternately.

Chemicals are fed at the start of each evaporator run through a pot feeder on the evaporator feedwater line close to the shell. On long horizontal evaporators the chemicals are introduced at each end for better distribution. It is customary to add the magnesium chloride first, followed by a water rinse of the line, and then to add the sodium hydroxide and aluminate together. This is to avoid plugging the lines with magnesium hydroxide precipitate. We have tried magnesium sulphate instead of magnesium chloride with equally satisfactory results. Freshly precipitated magnesium hydroxide seems to be preferable to magnesium lime in this application.

Differences in Makeup

While the quantities of chemicals added are not critical, they do vary with the nature of the evaporator makeup. In some instances, the boiler water alkalinity furnishes enough hydroxide for the evaporator treatment, in others the raw water contains sufficient magnesium salt. Although the evaporators have been operated on the batch basis, "cracking" or draining them at set periods, consideration has been given to continuous feeding of chemicals and continuous evaporator blowdown.

Typical data in the table, pertaining to five different steam plants, show the conditions for a variety of waters and equipment when using magnesium chloride-sodium hydroxide treatment and boiler blowdown to the evaporator.

All tests for silica were made by the ASTM method. Silica in evaporator vapor from untreated raw water makeup varied from 0.2 to 0.5 ppm, whereas with treated evaporator makeup it ranged from 0.005 to 0.03 ppm. Similarly the silica in the untreated shell water was 8 to 12 ppm for a filtered sample, compared to 1 to 3 ppm treated. Unfiltered, treated shell water contained as much as 65 ppm total measured silica, which indicated that most of the silica was retained in the suspended matter.

It is desirable to maintain the silica in the evaporator vapor at a minimum, preferably less than 0.02 ppm. In general, it has been possible to accomplish this with the magnesia treatment when the shell water had a pH 11.5 to 12.0 and zero hardness. Better results could be obtained in Plants B and E in the table by increasing the sodium hydroxide. The ratio of sodium hydroxide to magnesium chloride added to an evaporator with raw water makeup and no boiler blowdown is approximately two to one; but changes must be made to suit specific conditions.

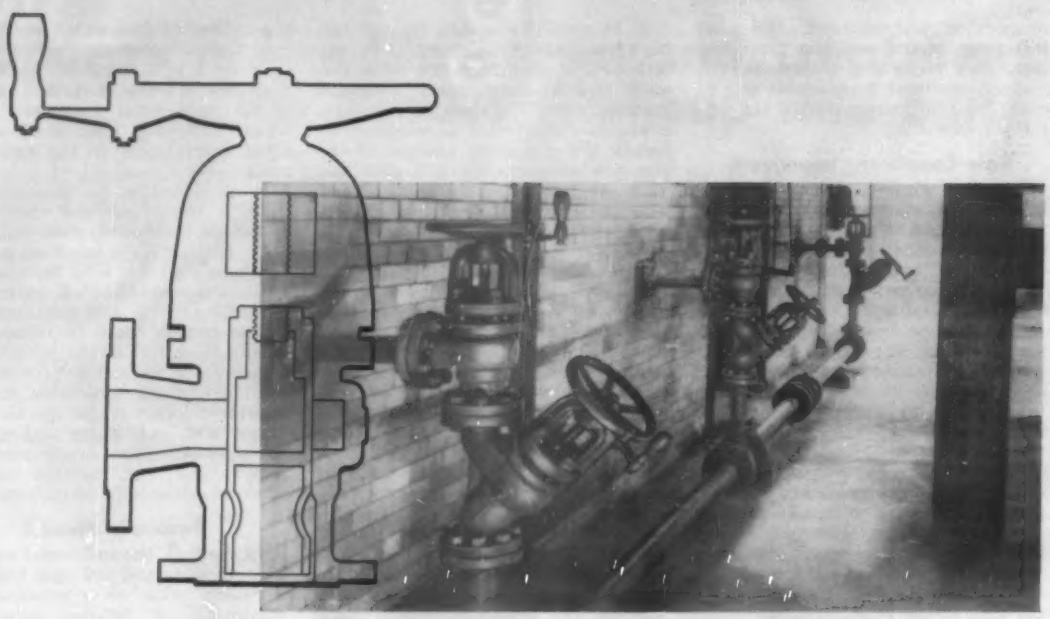
Results in Plant C

In Plant C, the well water contains 21 ppm silica and 400 ppm hardness. Formerly with no evaporator pretreatment or internal treatment, turbine No. 2 extraction pressure would increase from 30 to 52 psi every ten months, at which times it would be necessary to remove the silica from the turbine. To maintain the boiler water silica less than 3 ppm was difficult due to a shortage of condensate caused by excessive boiler blowdown. The length of an evaporator run between crackings was 1500 gallons and the evaporator was badly scaled. Now, when using evaporator treatment, there is no appreciable scale and the sludge is easily flushed to waste.

Maximum concentration carried in the evaporator shell is approximately 2500 ppm, although in some cases the limit has been set back to 1250 ppm because the shell water has a tendency to prime. On certain occasions when there was oil in the river water makeup, we have added antifoam to the evaporator treatment. In Plant E the well water contains 25 ppm silica, 780 ppm hardness and 390 ppm sulfate as SO_4. The high sulfate is a limiting factor in the evaporator shell water concentration, for the cold lime process does not reduce the sulfate content of the water.

It would be costly to treat some of these waters with deionizers for silica removal. On the other hand, lime, magnesium chloride and sodium hydroxide (which represent low cost chemicals) have been used with evaporators to control silica. At times when the water supply is not too high in silica, the lime pretreatment may be omitted.

In developing this method for silica control in evaporators, credit is given to a large number of employees of the Northern States Power Company, especially to James M. Ford and other personnel of High Bridge Station where the procedure was initiated.



Typical blow-off valve installation. Correct overhaul methods insure longer life

Good Maintenance Adds Years

An annual program of inspection, overhaul, and repair of blow-off valves will pay dividends in the form of years of additional service life. However, unless maintenance procedures follow correct practice, useful valve life may be shortened. Here are the proper steps to be taken in overhauling the seatless-type blow-off valve

(All photos courtesy Yarnall-Waring Co.)

Fig. 1. To disassemble valve, remove yoke nuts and springs, turn handle as in closing valve to raise yoke above studs. Replace two nuts on studs, under yoke, then turn handle to jack whole assembly out of valve body. Finally remove lube fitting stop screw (arrow) to free glands and packings

Fig. 2. Inspect plunger for evidence of scoring, corrosion, or damage to threads. Check packing rings. Due to importance of proper sealing, it is best to install a new set of packing rings when overhauling. If old style welded plungers show signs of wear, replace with new pinned head type

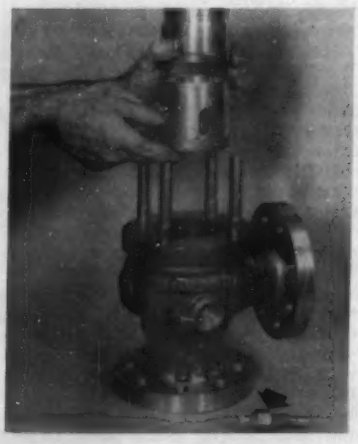


Fig. 3. Before reassembling, be sure all old packing is removed from body; place lower packing in body and press down with lower gland. Align groove in lower gland with stop screw hole and install screw. Install the upper packing ring and upper gland. Cleanliness during assembly is important

Fig. 4. Inspect ball thrust bearing (arrow). If necessary, clean bearing in solvent. *Caution:* Do not spin dry bearing with air at high speed; if used, air must be dry. Lubricate with superheat mineral oil. If scored, replace bearing. New ball-bearing yoke is available to replace older models

Fig. 5. To reassemble, oil inside of glands and place yoke-plunger assembly in body (as in Fig. 1). Turn wheel counterclockwise to lower yoke over studs. Replace springs and nuts. Nuts should be tightened alternately on opposite sides until springs are almost fully compressed coil to coil

Fig. 6. Lubricate ball thrust bearing through the lube fitting at top of yoke (arrow); lubricate plunger and glands through fitting on stop screw. Use only superheat mineral oil for lubricating these points and the stem threads of the plunger. Do not use grease of any kind on seatless valves

# of Service to Blow-off Valves

Three important steps in the overhaul of the double-tightening type of blow-off valve are illustrated in Figs. 7, 8, and 9, below. The disk in these valves should be inspected for scores, scratches, and other marks. If too deep to be lapped out, disk must be replaced. Whenever valves are disassembled, renew all packings and gaskets

Fig. 7. To service double-tightening type blow-off valves, unbolt the two halves and place cap in vise with stem hole up. Apply fine grinding compound to disk surface; use disk surface as a lap to produce smooth, uniform seating surface. In lapping, use random circular motion of the disk

Fig. 8. Assemble parts in body and cap for lever-operated valve as shown above; if gear-operated, reverse disk face. Lubricate sealing bushing and disk with superheat mineral oil. Bolt cap and body assemblies together. Tighten all nuts evenly, alternating from side to side to avoid distortion

Fig. 9. Double-tightening blow-off valves have only one lubrication fitting — that which lubricates the stem. Apply superheat mineral oil to this fitting after assembly. After overhaul, use new flange gaskets when re-installing in line. The illustration shows the lubricating operation

Electrical

Fig. 1. A few seconds after detonation the blast looked like this

The results of the atomic blast at Yucca Flat on May 5 indicated that electric utility equipment should withstand a nuclear explosion better than the residences and industrial buildings it serves. While there was some damage to the electrical installations it was of such a nature that it could have been repaired very quickly

IF THE NUCLEAR TEST explosion at Yucca Flat on May 5 indicated anything, it certainly demonstrated that conventional outdoor electric utility equipment withstood the blast to a far better degree than the residences and the industrial structures to which the electric system supplied power.

As will be seen from the photographs on these three pages, which were all taken during or after the blast, the outdoor transformers, the substation and the steel transmission towers, all on the 4700-ft line, were relatively undamaged. One of the 69-kv towers, not shown in the photographs, did fail structurally. This was a light suspension tower holding a 600-ft span of 2/0 copper. As shown in Fig. 2, the relay house for the substation had panels dished in and the foundation uplifted. Batteries were knocked from the shelves but the instruments were practically undamaged.

The substation appeared to be in operable condition with all major units standing. Four of the 15 wooden distribution poles were broken off near their bases. This damage was apparently due to blast and missiles. The three 50-kva transformers were

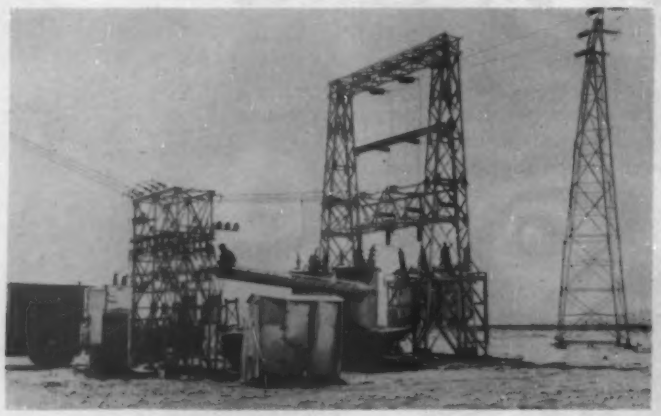


Fig. 2 (*Above, left*). Little damage was suffered by the transformers and the substation. One steel tower, however, failed structurally

Fig. 3 (*Lower left*). This one-story frame house was at the same distance from the blast as the equipment shown in Fig. 2. It was completely demolished as is plainly evident

Fig. 4 (*Above*). The wood-pole distribution line on the 4700-ft line was badly damaged. Four of the 15 poles were broken off

Equipment Survives Atomic Blast

blown off the two-pole platform shown in the background of Fig. 3. The portion of the secondary system which was operating during the time of the shot was no longer operable afterwards. Secondary lines which were broken, however, could have been replaced very quickly, in fact, it is obvious that the entire system could have been placed back in operation before the time a damaged area would actually have need for electric power.

Practically all of the damage to the electric utility equipment was on the 4700-ft line. As described in the June issue, there were two practically identical systems, one at 4700 ft from ground zero and the other at 10,500 ft from ground zero. There was no apparent damage to any of the equipment at 10,500 ft.

The resistance to nuclear blast of strong pressure vessels as compared with that of ordinary building structures was shown by the liquefied petroleum gas tank installation on the 4700-ft line. As shown in Fig. 8 and 9, this tank, which contained 15,400 gal of liquefied petroleum was undamaged. All valves and piping were intact, no gas was leaking, and the entire contents remained available for use. Only the ladder and the walkway on top suffered superficial damage. The steel frame cylinder-filling building next to the tank was, however, completely destroyed. Fig. 8 shows this building disintegrating.

Among the various pieces of mobile equipment subjected to the blast, the rescue vehicle at the 1470 ft line was completely wrecked. This, of course, was extremely close to the tower. On the 4700-ft line, one electric utility

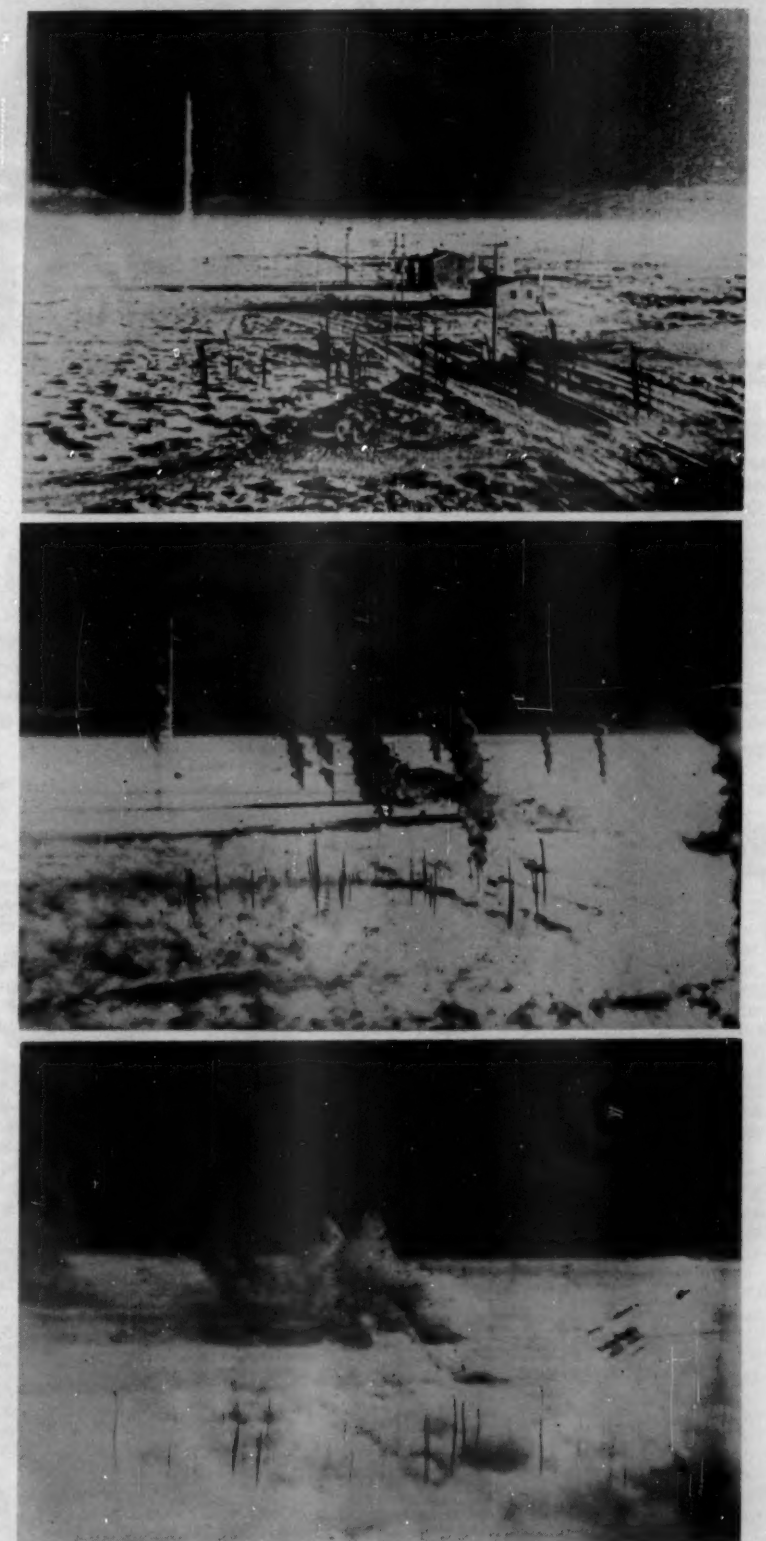


Fig. 5-7. The three photographs at the right show three successive exposures of the same scene. These were taken by an automatic camera at high speed. The upper picture was taken at the moment of the flash. It shows utility poles, the 2-story brick house, the 1-story frame house, and 1 self-supporting radio tower, all at 4700 ft from the blast. The middle picture shows the same scene a moment after the flash but before the blast wave had arrived. The utility poles are smoldering and the vapor is rising from the desert. The lower picture was taken at the instant the shock wave arrived. The radio tower is toppling, some of the utility poles are faintly visible—one is falling. Other structures are obscured by the dust from the blast wave. Both of the residences were completely destroyed.

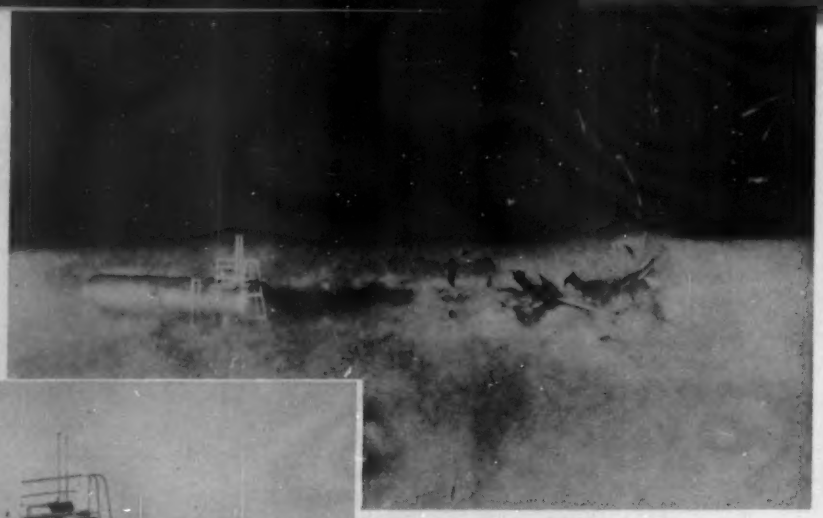


Fig. 8 (*Right*). View showing the 1-story steel frame shed disintegrating as the blast wave hits. The 15,400-gal liquefied petroleum gas tank at the right of the shed was relatively undamaged

Fig. 9 (*Below*). View of the liquefied petroleum gas tank after the blast. Only the ladder, the railing and the walkway on top suffered any damage

Fig. 10. Wreckage of the 2-story brick house on the 4700-ft line

truck which was head-on to the blast had the windshield shattered, both doors and cab dished in, the hood partly blown off and one compartment door dished in. There was no apparent damage to tools or equipment. Also, at the 4700-ft line was an electric utility truck equipped with an earth boring machine, which was broadside to the blast, and which was overturned. The top of the cab was dished in and the door on the side facing the blast was badly damaged. The earth boring machine was knocked loose from the truck and was on its side, leaking gasoline and water. A utility truck at 10,500 ft, faced head-on to the blast was little damaged. The back and two side windows were cracked and one side panel dished in.

The atomic device exploded on May 5 in "Operation Cue" as this Civil Defense Test was called, was estimated to have had a power of between 30 and 35 kilotons, TNT equivalent. In terms of some of the thermonuclear bombs exploded in the Pacific recently, this was a mere firecracker — the effects were on a laboratory scale. Yet, this blast destroyed most of the houses at a distance of about a mile and did considerable damage to some of the structures much further away. One utility building at 15,000 ft was, in part, severely damaged and another utility building at 6800 ft was completely destroyed. At the 4700-ft line the sudden increase in pressure due to the blast wave was 6 psi.

NOTE: It was not possible in the space available here to present a more complete account of the effects of this blast but a more detailed account is given in the June 3 issue of *Atomics*. We shall be glad to send you a copy of this issue of *Atomics*, free, if you write the Editor or jot OPERATION CUE on return post card elsewhere in this issue and mail it to us.

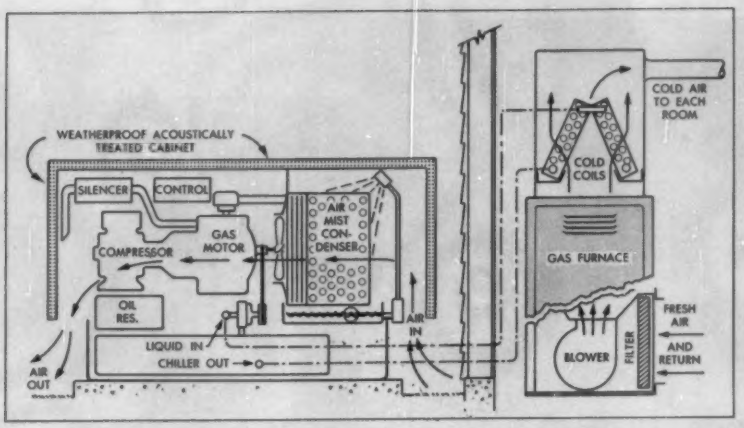


Diagram of the gas-motor-driven air-conditioning system, showing the cold coils mounted in a standard forced-air gas furnace. Unit is mounted outdoors in sound-deadening cabinet; exhaust is inside the cabinet. Compressor is direct-connected

On The Boards .... Gas-Powered Air Conditioning

Air conditioning's influence on summer loads might be partially offset by new developments on the drawing boards of the Coleman Co. and several researchers they have retained. Objects: Ease summer electric loads, boost summer gas loads, boost gas appliance market

SELDOM DOES a manufacturer tell the world what is in its research labs and exactly what it plans to put on the market. The Coleman Co. did, however, and openly invited its competition to put out comparable products. The products: gas-powered domestic air conditioners in ½- to 7½-ton capacities.

Reasons given by Coleman's president, Sheldon Coleman, for inviting other gas appliance manufacturers into the field were to a certain extent (but not entirely) altruistic. He believes that the future of gas air conditioning depends on technical excellence which is best fostered by commercial competition. He also points out that gas air conditioners must be developed to protect the winter heating gas load; as it is now, installation of summer air conditioning in a home nearly justifies the inclusion or substitution of a heat pump and resistance heating for year-around air conditioning. When such a trend develops, it will be at the expense of the winter gas heating load. While such a line of thinking seems quite a projection into the future, we agree that it is sensible thinking. Certainly, the incentives for utilities to sponsor electric-powered heat pump systems are great. Widespread use of summer air conditioning without electrical winter heating could make a big chunk of the electric load as seasonal as the market for swim-suits.

At $0.50 per thousand cu ft for gas, the Southern Gas Association could increase annual revenues $65,000,000 (without added capital investment) if only one-sixth of the homes in the represented states were air conditioned with gas. On a national basis, this implies an increase of hundreds of millions of dollars in gas revenues without increasing investments. The job of building up a summer-cooling load seems considerably easier for the gas companies than for electric utilities since they need not simultaneously promote winter heating; that load is already built up.

When Coleman got serious about gas air conditioning, they studied all possible gas-powered cycles to determine their potential. They came out of the preliminary study with ten systems, but later narrowed these down to four. These four, which show the most promise, are:

(1) Mechanical system using gas internal combustion reciprocating motor to drive the compressor.

(2) Binary jet system, using two working fluids in two jet pumps.

(3) Absorption system, using some form of vapor absorber such as silica gel.

(4) Open absorption system, which does not require a pressure-type refrigerant.

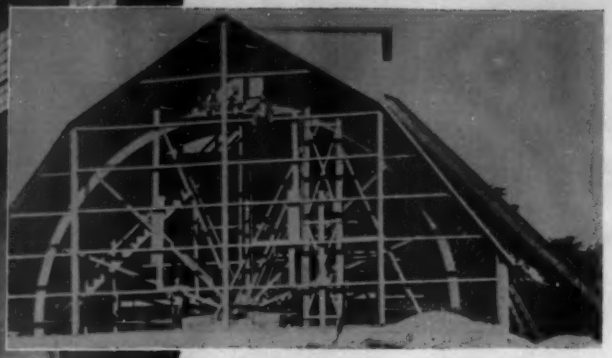
Of the four systems mentioned, the first is the most conventional and the most advanced. It has had two years of field testing which confirm its ability to meet all but one of the design criteria — initial cost. The unit as it exists today (in 3- and 5-ton sizes) will cost somewhat more than a comparable electrical unit, but the manufacturers are counting on the lower operating cost to sell it. Assuming 2-cent-per-kwh electric power and 70-cent-per-thousand-cu-ft gas, the new unit will cost about half as much to run (including cost of gas, electricity and water).

Though the motor-driven unit sounds like a standard electrical unit with a lawn-mower motor where the electric motor belongs, it is somewhat more involved than that. The motor, for example, is designed to operate a full cooling season between oil changes, plug change, and replacement of the distributor points (something over 2000 hours). It is to operate 10,000 hours between overhauls — something like five seasons — which is roughly equivalent to running an automobile engine at 50 mph for 500,000 miles. The entire unit is housed in an acoustically-engineered enclosure for outdoor mounting; air is ducted through the enclosure in such a manner that the exhaust pipe is inside the housing but the fumes are promptly forced outside. While the system employs no conventional cooling tower, it does have a unique "wet-bulb condenser," which keeps the condenser tubes covered with a thin film of evaporating water at all times. Air drawn over the wet condenser is considerably cooler than ambient dry-bulb temperature and is used to cool the motor (see diagram).

Few details are available on the unique "binary jet system," but it is described as using two jet pumps and two working fluids. One fluid system is used to "drive" the unit, while the second produces the refrigerating effect. Mercury and alcohol have been tried in combination, but mercury seems to be lacking some property sought by the researchers. Arthur D. Little, Inc., has the development contract on this system, which seems to be devoted primarily to a search for the most desirable working fluids. Low first cost is said to be the principal advantage of the binary jet systems.

Even lower in first cost would be the *ad*sorption system, which is being developed for Coleman by the Texas College of Arts & Industries. Another big advantage is the system's ability to operate with variable dehumidification in any cooling range. If the system can be built in small sizes (and there is reason to believe that it can), it should be very popular in humid areas and/or where the cooling season is short.

In Chicago, the Institute of Gas Technology is working on the fourth Coleman system. The open *ab*sorption system requires no pressure-type refrigerant, and also provides separate humidity control. Few details are available on this unit.



Young for an old-timer, this 30-year-old all-steel, 50-ft-diam overshot water wheel once drove a 70-kw generator. It is now a tourist attraction in Wisconsin

(Left) Somewhat smaller than the wheel shown above, this Allis-Chalmers Francis wheel is of cast steel and will develop 57,500 hp when installed at the Fort Randall Dam (Pickstown, S. D.). By fall eight identical units will be installed

Power Engineering • Power Engineering • Power Engineering •

Consolidated Edison's new 300,000-kw turbine generator is discussed here by its "parents"—GE managers Schabtach (engineering), Neblett (marketing), Saupe (large steam turbines), and Pruessman (manufacturing), left to right. Unit will be cross-compound type with 2000-psi, 1050 F throttle, steam reheated to 1000 F

Hot, wet, high-pressure steam hastens the high-strength cure of these concrete supports in GE's I-limiting reactors

Radioactive Cobalt 60 furnishes the energy for this "Isoscope" to radiograph up to 7 in. thickness of steel. It is at B & W's Barberton, Ohio, plant

Internal cooling reduced the weight and dimensions of this Westinghouse generator. Rated at 156,250 kw, it will be installed outdoors at Louisiana Power & Light's Westwego plant

Toledo Edison's new Bay Shore plant is scheduled to go on the line some time this fall. A 165,000-kva oil-filled, water-cooled transformer will step up the output of its first unit

Fig. 1. Engine analyzer, for diagnosing ills of spark-ignited engines, displays entire ignition story on face of picture tube

New "TV" Engine Analyzer

Analysis of ignition system malfunctions in the spark-ignited gas engine is frequently a trial-and-error, hit-or-miss proposition. Cathode ray engine analyzer takes out guesswork, adds accuracy

By WALTER A. SPERRY *

MALFUNCTIONS that arise in the ignition system of a spark-ignited gas engine are among the most difficult to diagnose of all the ills to which internal combustion engines are subject. Furthermore, except for obvious manifestations, it is not often known whether or not the system is malfunctioning.

Inspection and testing of the circuit and its parts under static conditions — when the engine is down — sometimes fails to reveal faults; yet, when the engine is running under load, its performance and efficiency may be below standard. This baffling condition is, of course, brought about by the very nature of the equipment. The mechanical working parts of an ignition system, such as the magneto and distributor, are so completely enclosed in housings that visual observation under operating conditions is impossible; and, short of elaborate laboratory equipment, the electrical phenomena occurring in the circuit are unseeable.

Instrumentation developed in the past attempted to display electrically, by means of meters and oscilloscopes, results of certain mechanical and electrical occurrences during the ignition cycle. Although these practical field test sets are valuable to the trouble-shooter, they are not designed to present the whole story of the complete ignition cycle in all cylinders simultaneously.

An instrument that accomplishes this has been developed by the Socony Mobil Oil Company. Called the cathode ray engine analyzer, this 60-lb instrument is completely portable and displays on the tube face a picture of the entire ignition story — as it is happening (Fig. 1). Basically, the analyzer is an oscilloscope, automatically synchronized to engine crankshaft position.

Power is supplied to the analyzer through an extension cord that plugs in to a standard 110-v, 60-cycle a-c power outlet. Connections are made to the engine (Fig. 2) with two leads: one that clips over the insulated wire from the distributor or magneto to No. 1 spark plug and another that clips over the insulated wire from the coil to the center of the distributor cap. In the case of a magneto, this latter lead is clipped to the external ground wire from the cap. (In some cases, the wire is internal and special connections must be made.)

It is also possible to carry the instrument in an automotive vehicle and check engine performance under

* Superintendent, Aurora Sanitary District, Aurora, Ill.

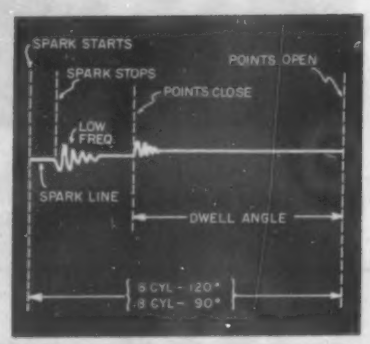


Fig. 3. Diagram shows pattern of events in ignition cycle as presented by the cathode ray engine analyzer

Oscilloscope pattern photos courtesy Socony Mobil Oil Co.

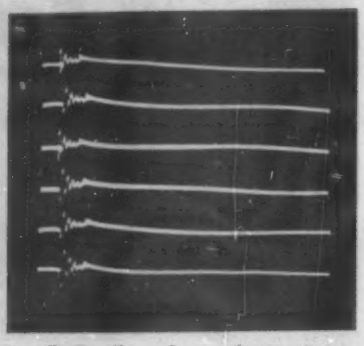


Fig. 7. Dwell angle too large. *Points close* signal too far left. In this case, long dwell time can burn points

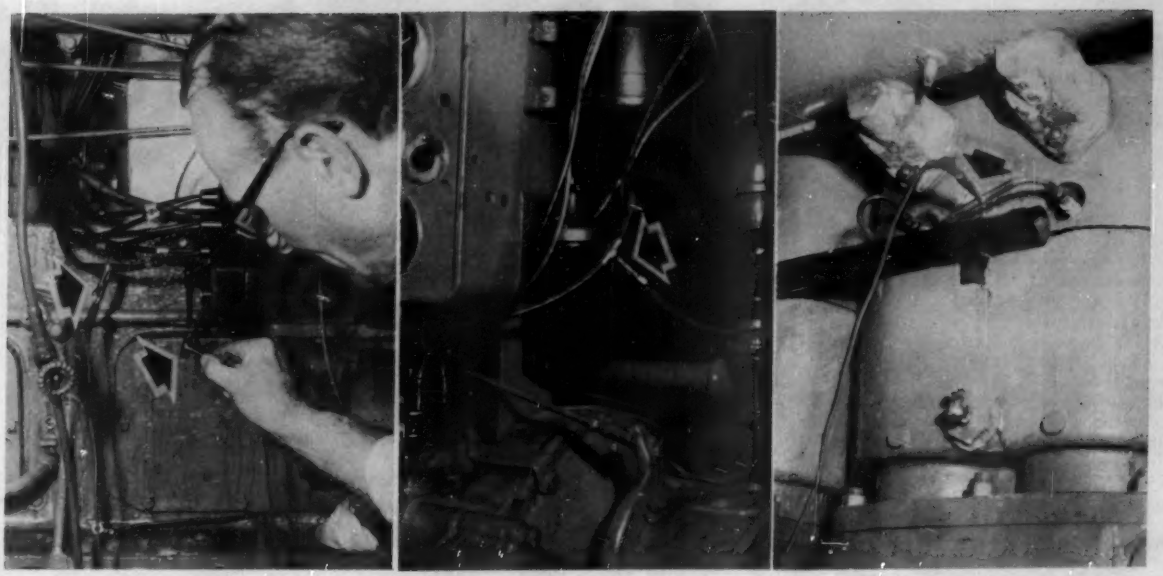


Fig. 2. Analyzer connects to engine easily; simply clip lead to magneto (*left*) or distributor (*center*), and No. 1 plug (*right*)

Will Find Hidden Engine Faults in Minutes

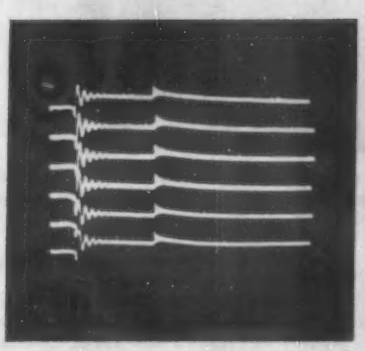


Fig. 4. Standard pattern of 6-cylinder engine. Traces are in firing order, top to bottom; in this case, 1–5–3–6–2–4

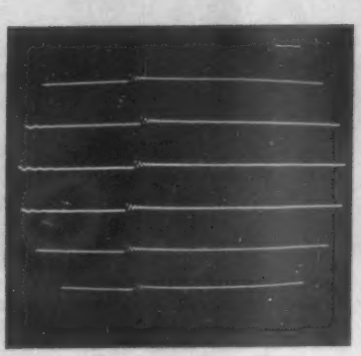


Fig. 5. Cam wobble is indicated here by vertical "S" curve through *points close* signal. This section expanded

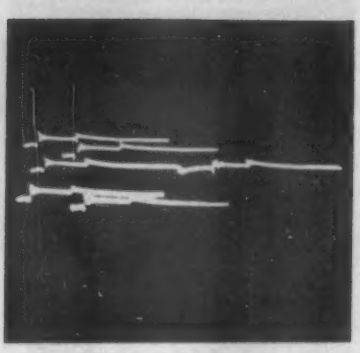


Fig. 6. Crossfire in distributor cap. Condition usually due to a wet, dirty, cracked or carbonized distributor cap

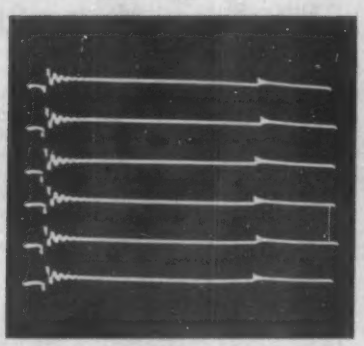


Fig. 8. Dwell angle too small. *Points close* signal too far right; time for adequate coil saturation insufficient

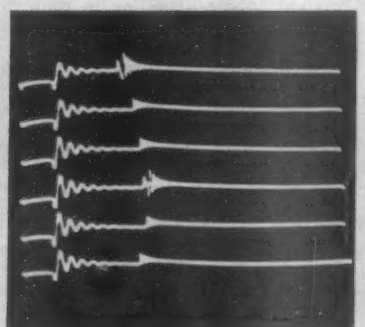


Fig. 9. Points bounce at closing. Defective breaker point operation evident by double image on lines for 1 & 6

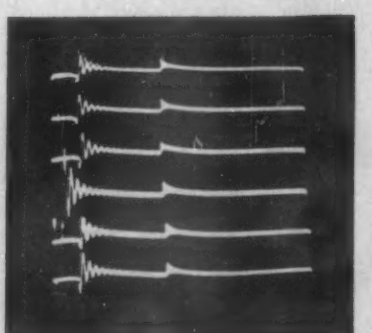


Fig. 10. Spark plug almost misfire. No. 6 cylinder trace shows practically no spark line and wide excursion wave

actual road operating conditions. In these circumstances, the analyzer operates from the 6-v or 12-v d-c available from the vehicle battery.

Events in the ignition cycle are portrayed on the face of the picture tube in the form of visual dynamic patterns. Typical displays are shown in Figs. 4 through 10. The ideal form of the pattern is shown in Fig. 3, which identifies events in the ignition cycle of any one cylinder as portrayed by the analyzer. All actual patterns shown are those from six-cylinder engines.

Since the triggering impulse comes from No. 1 cylinder spark plug lead, the pattern for that cylinder is topmost in the array; the subsequent traces appear in the firing order of the engine, usually 1–5–3–6–2–4 in a six. Thus, any malfunction in a given cylinder can be isolated immediately by noting where in the array the deviation occurs. For example, observation of the pattern in Fig. 10 discloses that the defect exists in No. 6 spark plug.

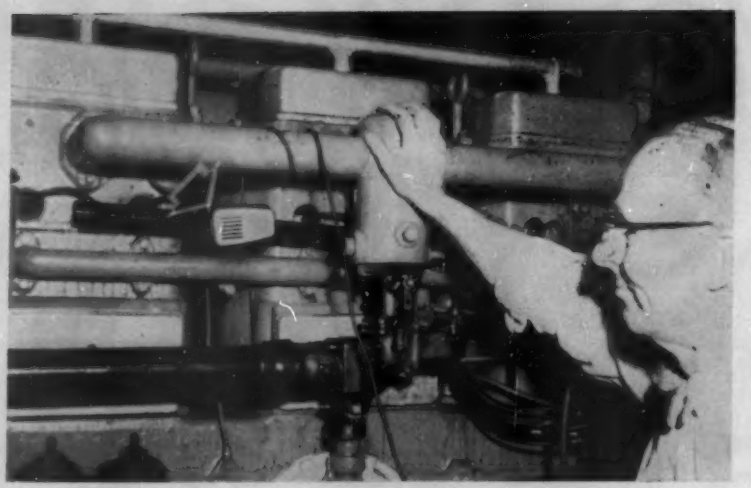


Fig. 12. Analyzer can be used with a microphone (*arrow*) for analysis of engine noise. Detonation within a cylinder or cylinders can be traced to source of noise

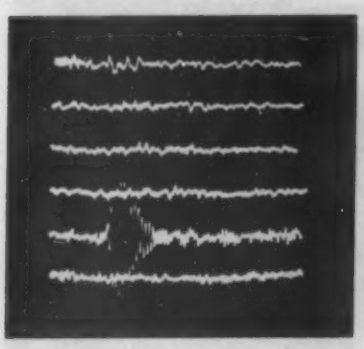


Fig. 11. Result of a detonation test shows heavy knock in cylinder No. 2

Fig. 13. Engine malfunctions usually are clearly represented by mechanical vibrations. The clamp-on vibration pick-up (*arrow*) can reveal the significant patterns

The analyzer detects virtually all ignition system troubles, including such common faults as spark-plug fouling and misfiring, open or short-circuited plugs, defective wiring and switches, worn distributor cam and shaft bearings, and defective coil, condenser, or magneto. Burned distributor points are easily identified, and the analyzer can be used to diagnose pre-ignition faults, noise, vibration, or combustion knock. Picture patterns depicting about 65 different engine ailments have been observed; still other patterns have yet to be identified, but a continuing study of these will probably yield further information on engine analysis.

An example of the value of the analyzer in diagnosing obscure ignition defects was disclosed during a recent routine test made on a six-cylinder Climax dual-fuel, spark-ignited gas engine at the Aurora Sanitary District's Sewage Treatment Plant. So far as could be determined by casual inspection, this engine was performing its usual dependable pumping job. However, 30 seconds after the engine analyzer was connected to the ignition circuit it was discovered that there was an insulation weakness in the lead to No. 6 cylinder from the distributor. Also disclosed was somewhat erratic cam operation that indicated replacement of this part during the next overhaul period. Neither of these conditions would normally have been brought to our attention in time to preclude actual failure or malfunction of the items in question.

Spark plug misfiring, a common trouble of engines in service, is readily determined by the analyzer. This can be an important service since the appearance of the parts cannot be used to judge their performance — new spark plugs, for instance, may often give poor performance when installed.

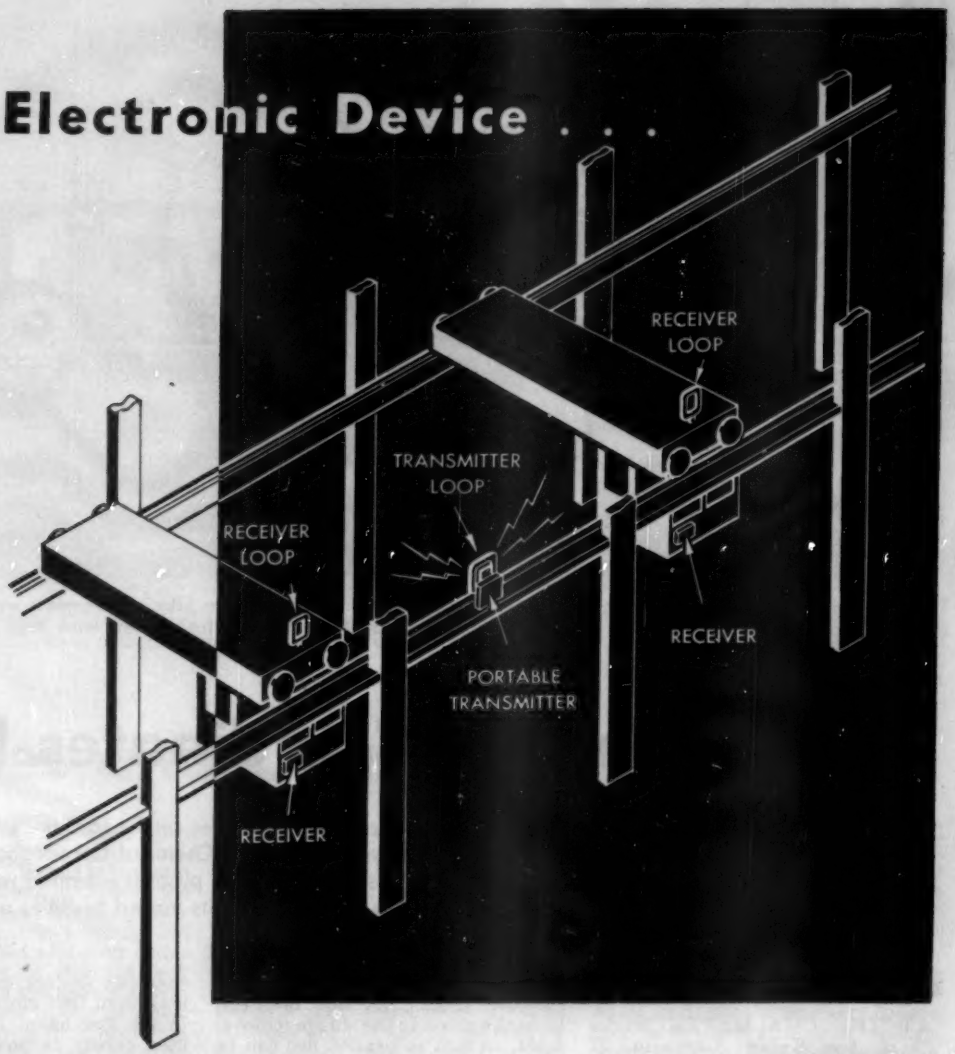
The dwell time of the system is controlled by the setting of the breaker points and regulates the d-c energy input to the coil. This setting can be determined and adjusted with great accuracy, with reference to crank angle, by measuring the angularity indicated on the pattern displayed on the tube face. Figs. 7 and 8 show the appearance of long and short dwell angles, respectively.

Detonation tests can be made with microphonic pickups such as those shown in Figs. 12 and 13. A detonation signal from No. 2 cylinder is displayed in Fig. 11. The wavy background lines of this array are normal noise signals originating from valve closing, combustion, etc.

Although the cathode ray engine analyzer is relatively simple to operate and interpret, operators must be trained to use the instrument in order to extract maximum benefits from it. At the present time, Socony Mobil field automotive engineers utilize the analyzer in field work; but it is reported that the Allen B. Du Mont Laboratories will manufacture and sell the device under a licensing agreement with Socony Mobil.

For more information, write the Editor, or jot ENGINE ANALYZER on the prepaid post card in this issue and mail it to us

New Electronic Device . . .



Designed to Reduce Crane Accidents

INTERESTING new control system for crane runways will soon be available for industry. Developed primarily as a safety device, the new system permits workers to attend to a disabled crane without danger from other cranes approaching on the same runway. The system automatically gives warning of the approach or shuts off the movement of an oncoming crane. Distance at which the warning or shut-off action is effective is adjustable from one to twenty feet with the proper setting made at time of installation. Other similar applications to protect workers are practicable, and should help reduce accidents, though, like all safety devices, they should not be considered substitutes for good training and discipline.

Equipment consists of a compact receiver and receiver loop for each crane or other fixed location and a portable transmitter with transmitter loop to be positioned wherever temporary protection is required. The transmitter and receivers are tuned to the same carrier frequency. At a predetermined proximity, sufficient energy is transferred from one to the other to actuate the impulsed receiver by the high steady output of the transmitter.

All of the equipment is of "fail-safe" design so that any failure of any part will cause a warning signal instead of a mute shut down. A sensitivity control on each receiver determines the distance at which the receiver relay is held energized by the transmitter loop. This provides a flexible field adjustment for setting the warning to become effective at any desired distance.

Power on the crane is normally drawn from the "trolley" circuit used to operate the cranes. The portable unit is battery operated. All equipment is made for heavy duty industrial use with more than ample protection and resistance to dust, moisture and shocks of all kinds.

For more information about this equipment write to the Editor or use one of the prepaid postcards elsewhere in this issue. Just write CRANE SAFETY on the card and mail it to us.

Fig. 1. Domestic water treatment plants are rated at combined capacity of 1,200,000 gal per day and operate on chemical flocculation principle. Domestic water storage tank and elevated fire tank at left each store 100,000 gallons

How Chalmette Coördinates Power

Fourth and last of a series of articles on the facilities at the Chalmette plant of the Kaiser Aluminum & Chemical Corporation in Louisiana, this installment describes how the plant is supplied with its auxiliary services and the manner in which its varied facilities are coördinated

By E. F. BOOBYER*

AT THE CHALMETTE Works of the Kaiser Aluminum & Chemical Co., the Domestic Water Plant supplies a nominal maximum of 1,200,000 gpd to the entire plant and is the only available source of purified water. The Mississippi River supplies raw water to the plant where it is first processed through a presettling tank. Here, during an eight-hour retention time, the introduction of aluminum sulphate and lime forms a floc to precipitate the major part of the suspended solids in the turbid river water. At the end of the presettling period, the water is chlorinated and then passes to the reactor tank.

Incoming water rises from the bottom of the reactor tank and, during a period of two hours, passes through an aluminum sulphate floc blanket to be further clarified before going to the reactor tank outlet. Here, lime is added to correct the pH to about 7.6, and activated carbon may be added to remove any remaining taste or odor.

The clarified water flows to the sand-bed filters where it passes through the beds by gravity to the clearwell tanks. The filter beds can be backwashed to the sludge removal moat, so that suspended floc can be periodically washed from the filter beds.

Automatically-operated pumps deliver the clarified water from the clearwells to the domestic water distribution system. As the water is pumped from the clearwells it is automatically chlorinated for the second time.

A crew operates the water treatment plant as well as the river pump house. Within the water treatment plant is contained the alarm functions for the river pump house.

Various flocculating agents were tried before aluminum sulphate was selected as most efficient. Experiments are planned with a catalyst considered capable of allowing adequate floc formation with a reduced quantity of the flocculating agent. In an effort to kill air-borne and water-borne algae, a chlorinated amine is fed to the raw water before it reaches the presettling tank; this has proven highly successful at little expense.

Six Joy Manufacturing Company compressors, driven by 250-hp synchronous motors, supply a nominal maximum 7970 cfm of air at 110 psig to the Reduction Plant; this air is used chiefly to power the pneumatically-driven power tools used in the potline operations. These compressors are monitored by various tripping devices which insure against loss of cooling water, lube oil, etc. A low-pressure alarm in the steam plant announces when the system is not sufficiently supplied with air.

The Reduction Plant is equipped with scrubbing towers, the function of which is to remove smoke and gases from the air streams moving across the reduction electrolytic cells. River water is supplied to this operation from Worthington centrifugal pumps, rated at either 5200 gpm or 3600 gpm, to satisfy an average demand of 18,000 gpm at an average 62 psig discharge line pressure. This water is filtered under pressure through Cuno cylindrical rotary screens with a mesh opening of 0.012-in.

The loop cast-iron piping system comprising the firemain is fed with water at about 60 psig from either

*Power Manager, Chalmette Works, Kaiser & Aluminum Chemical Corp.

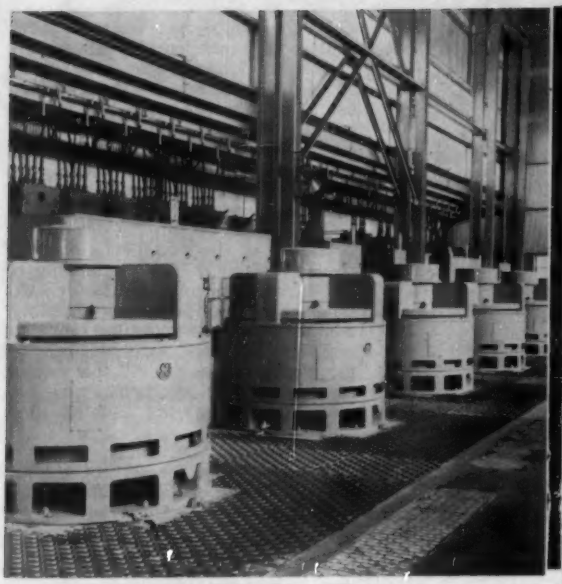


Fig. 2. Five of the eight main circulating water pump motors. Equipment is two 800-, three 600-, and three 1000-hp motors

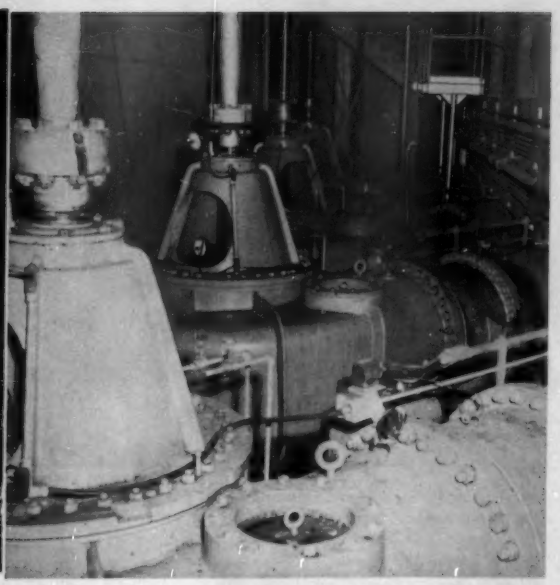


Fig. 3. Four of the eight main circulating water pumps; there are two 45,000-, three 35,000-, and 60,000-gpm pumps

Facilities and Operations

one of three sources, depending upon circumstances.

Normally, this firemain is fed from the Domestic Water Plant, where the coldwell pumps that normally deliver water to the domestic water system can be manipulated to deliver water to the 100,000-gallon elevated tank supplying head to the firemain. Water can still be fed to the domestic water system during this operation since sufficient pumping capacity exists.

The second source of supply is from the scrubber water system; water is automatically diverted from the scrubber supply main to the firemain in event the firemain pressure falls below a certain predetermined level. This water is filtered river water; the firemain and the scrubber supply mains can be paralleled without interference to either because of adequate pumping capacity.

An emergency gasoline-motor-driven firepump constitutes the third source of firemain water. This 150-hp pump is located in the River Pumphouse and takes water directly from the river to discharge directly into the firemain; the elevated water tower is checked off by this operation. 1500 gpm maximum is fed into the firemain by this emergency pump.

An extensive communications system is provided, so that the distances involved between plants and operators under the supervision of a shift foreman are less obvious and do not represent obstacles hazardous to sound operating principles. The communications system is by "Gaitronics", and specifically designed for power plant use and the noise levels usually found in such applications. Basically, it comprises two distinct public address systems, each equipped with a "loud" and "quiet" channel. Any operator can page any other on the loud system and then switch to the quiet channel during the ensuing conversation; this leaves the loud channel open for broadcast messages and instructions. The two separate systems can be merged at the master stations located at the prime control points, thus providing a plant-wide "loud" and "quiet" channel means of communication.

Six Master Sets

Master sets are located at the two control boards in the Steam-Electric plant, at the control board of the Gas Engine plant, at the control board of the Rectifier Station, the Machine Shop and in the River Pumphouse. Numerous handsets are located at strategic points, such as gauge and control panels, annunciator panels and the main machinery sites. Speakers are scattered throughout the plants and grounds to give extensive hailing coverage.

The Distribution Sub-Department of Operations is headed by a Supervisor aided by an Assistant Supervisor to whom four shift foremen report. These foremen supervise operators and cleaners and control the distribution of all high voltage a-c and d-c power, including the Rectifier Station, throughout the Power and Reduction Divisions. They are responsible for the loading of turbine-generators and gas engines, the high voltage switching and switchgear, step-down transformers, and substations. This does not include the 440-v and 2300-v auxiliary power supplies to power auxiliaries, which is under the control of the Generation Sub-Department.

The shift foremen of this group function as system operators and load dispatchers and work in close cooperation with the shift supervision in the Reduction Plant, so that a continuous and adequate flow of power is available to those facilities.

Generation and distribution supervision are housed in close proximity in the Operations offices in the Steam-Electric plant, so that rapid and close coördination of effort is enhanced. The generation people dictate the limitations of the generating equipment. The distribution people control the loading of the generating machinery and the dispatching of power to suit the demands of the Reduction Plant and the limitations imposed by the generation supervision.

Local annunciator panels, located at the principal control points provide adequate visual supervision of the plants. The various senior control operators permanently stationed near these boards use the communication system to direct the actions of junior

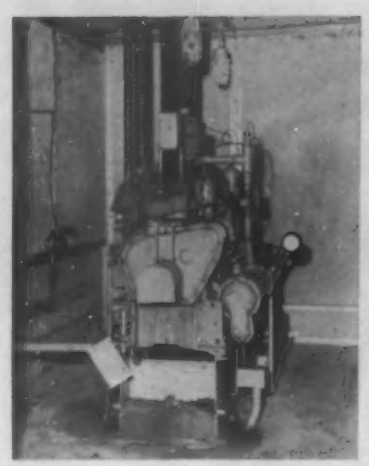


Fig. 4. 210-hp gasoline engine drives a fire pump rated 1500 gpm at 245 tdh

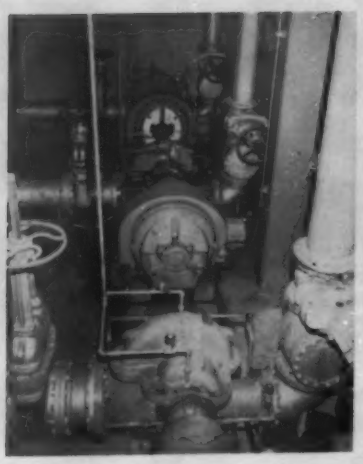


Fig. 5. Step I scrubber supply pumps rated at 5300 gpm; motors are 250 hp

Fig. 6. Steam Plant Step I control board. This board supplies control and annunciation for turbine-generators 1-A, 1-B, and 2 through 6; another, 7 to 15

operators and to warn the entire shift of impending system changes or actual troubles. There is no central annunciation and control point. The extent of the plant, the relatively widely scattered crew and the reliance upon rapid communications were considered to be factors negating the efficacy of complex and costly central control, indication, and annunciation.

All maintenance, exclusive of instrumentation and relays, is under the supervision of a Maintenance Superintendent. Maintenance responsibility at the supervisor's and foreman's level is by virtue of areas rather than by type of work. Thus each foreman has a mixed crew of mechanics and electricians and is responsible for the maintenance of his own area.

Other foremen are responsible for (a) yards, drainage, grounds, transportation, etc.; (b) high voltage overhead distribution and step-down transformers throughout the Power and Reduction Divisions; and (c) the Machine Shop, incorporating machinists and such specialists as welders, laggers, painters and air conditioning mechanics.

Maintenance of all types of relays, controls and instrumentation is under the jurisdiction of the Technical Department and is the direct responsibility of a foreman who reports to the Technical Supervisor. A crew of instrument men service all such equipment throughout the Power and Reduction Divisions with few exceptions.

Technical Department is headed by a Superintendent to whom reports a Results Engineer and Technical Supervisors. In addition to the Instrument Foreman, three engineers and a draftsman report to the Technical Supervisor. These engineers supply technical advice, technical scrutiny and technical reports relating to all maintenance within the Power Division (instrument, electrical and mechanical). They are free to submit constructive criticism concerning the methods and materials used by the maintenance groups and are called upon by these groups to give technical aid and advice whenever it is considered necessary.

Under the supervision of the Results Engineer are three Assistant Results Engineers, a Senior Technician and three Technicians. Each Assistant Results Engineer is responsible for technical scrutiny and aid with respect to the operations involved in his area. These engineers investigate all operational troubles, scan operating records, supply technical limitations to the Operating Department and advise the operators when called upon to do so. Additionally, they are responsible for the philosophy of the various automatic controls, for the check-out of all protective functions applied to the machinery and the testing of all machinery with respect to determining incremental costs and operating levels where optimum efficiency is evident.

The Senior Technician is responsible for supplying water quality control and scrutiny of all waters used throughout the plants; in this he advises Operations of the required use of the various chemicals to control the quality of domestic water, boiler water, evaporator makeup, cooling tower water systems, gas engine jacket water systems, and rectifier frame cooling systems, etc.

The Senior Technician directs the activities of the two Technicians in the electronic thermal balancing of gas engines, routine vibration checks on machinery, oil and water sampling, combustion tests at boilers and gas engines, "miking" wear and tear on gas engine parts, etc. All this data is supplied to the Results Engineer and his assistants as an aid to their activities.

The clerical staff under the Office Engineer is charged with the compilation of all statistics (operational maintenance, and technical) for the Division, the typing work and the various clerical control systems, linking the Division with other staff functions outside the Division and with Management. All daily operating summaries, monthly and annual operating summaries, graphical histories of lube oils and plant prime operating characteristics are the function of this group.

Also, this group is responsible for the processing of all supplies, the compilation of all quantity data relating to power, process steam, fuels, compressed air, and various waters sent to the Reduction Division and the various elements of the Power Division, so that the Accounting Department can assign dollar values and close-out the monthly and annual plant accounts.

The Office Engineer is also responsible for studies involving cost control, cost estimates, use of fuels and power, cost forecasts, and research into records as becomes necessary. He is also custodian of all Division records, prints, central files and similar data.

General Plant Statistics

Total installed generating capacity	478,200 kw
Total number steam-electric units	16
Total number gas-generator units	80
Average load factor	90 per cent
Average heat rate (HHU)	12,220 Btu/kwh
Rectifier Station Capacity	322,500 kw dc
Average load factor	82.5 per cent
Mill water capacity @ 62 psig	30,240 gpm
Condenser cooling water capacity @ 21 psig	8,258,000 gpm
Domestic water capacity	1,600,000 gal/day
Plant compressed air capacity @ 110 psig	7970.0 cfm
Process steam capacity @ 150 psig	20,000 M lb/hr
River Water Temperature	46 to 86 F
Average gas fuel quality	1,110 Btu/cf
Total plant area	280 acres

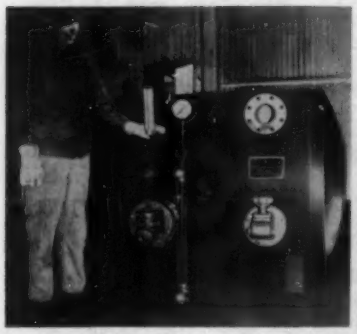
We Are Looking for Editors

POWER ENGINEERING is expanding and will have openings for graduate engineers in the mechanical or electrical field with a good solid background of operating, design, and construction experience. If you like to travel, meet people, learn of new developments, investigate new ideas, and if you have imagination, ingenuity and tact, together with a reasonable command of the King's English, you will find this interesting work. There are several openings, but the immediate one has the following specifications:

A graduate engineer from 45 to 50 years of age, who has gone through a cadet or student engineer's course with one of the public utilities, spent a number of years in the operating department, two or three years in the power sales department, and a number of years as power engineer with industrial companies, and who holds a professional engineer's license.

Not all engineers like to be editors, but the engineers who are editors feel it is a great profession. If you meet the specifications, or, as a potential associate editor, can fit into one of the several steps in the specifications, will you write, giving complete details of your education and experience, to an engineer who has been in the business for a generation? Write to the Editor, POWER ENGINEERING, 110 South Dearborn St., Chicago 3, Ill.

Now the Small Plant Can Get a Small Deaerating Heater



This external view of deaerating heater described in text shows its small size

NEW, SMALL SIZE, compact deaerating heater shown here is designed specifically for use in small plants. It is built for low initial cost, minimum maintenance, and limited headroom.

Corrosion and pitting of boiler tubes, condensate return lines, and accessories are usually caused by the presence of non-condensable gases such as oxygen and carbon dioxide in the feedwater. Reduction of corrosion by the removal of these gases is a constant problem in all plants. The deaerating heater, while heating the feedwater to the temperature of the operating steam, is designed to accomplish this removal. Recovery of waste steam for use in the heater prevents loss of thermal energy and results in appreciable fuel savings.

This new deaerating heater is a two-stage, spray type heater containing an internal vent condenser of stainless steel. In the initial stage, incoming water is sprayed into an atmosphere of steam, where its temperature is instantly raised to within a few degrees of the steam temperature. This spraying action is designed to remove almost all carbon dioxide and oxygen dissolved in the feedwater.

The water then flows into the second stage of the heater where it comes into intimate contact with fresh steam, which scrubs the water and then rises to the first stage of the heater, carrying with it all remaining traces of non-condensable gases. Here the steam heats the incoming sprayed water before being condensed by the internal vent condenser. The condensed steam remains in the heater as feedwater while the non-condensable, corrosive gases are vented free to the atmosphere.

Capacities range from 500 lb of water per hr to as high as 16,000 lb per hr, the latter being the biggest one of this type now made.

Diameter for all capacities is 4 ft, with the length being varied from 3 ft to 7 ft depending on capacity. Headroom for all capacities is no more than 4 ft 3 in.

Water storage capacity for the largest heater, i.e. 16,000 lb per hr, is 365 gal.

The heater is easily installed and comes completely equipped with all accessories in a wide variety of sizes. Minimum heater elevation is obtainable by combining the heater with a low NPSH boiler feed pump. This small, efficient unit is also available as part of a packaged feedwater treatment system including a low NPSH boiler feed pump and automatic zeolite softener — providing complete boiler feedwater treatment in one compact unit.

For more information about this unit write to the Editor, or use one of the prepaid postcards in this issue. Just write DEAERATING HEATER on the card and mail it to us

Plastic Tape for Color Coding

THERE IS always a better way of doing any given job. We wonder if you have thought of this one.

Color-coding of piping in plants is a well-established practice. Painting stripes around isolated piping is difficult, however, and a neat job requires masking tape or special brushes for ruling. The logical question arises: If you are going to use tape, why not use a colored tape and forget the painting?

Similar tapes are also available which include lettering and standard signs required in industrial plants. These can be used to identify fire extinguishers, locate exits, identify valves and switches, and point the way to emergency equipment. Several manufacturers deal in these products and their prices are reasonable. Why not consider them the next time you have a marking job?

"There's a leak in your department, Mac! The wife's already found out about that raise I got six months ago!"

How to Grout Power Equipment

For every piece of equipment there is one grouting method for best results. Here's a review of some of the most commonly used grouting methods in use today, with main points to be observed in each case

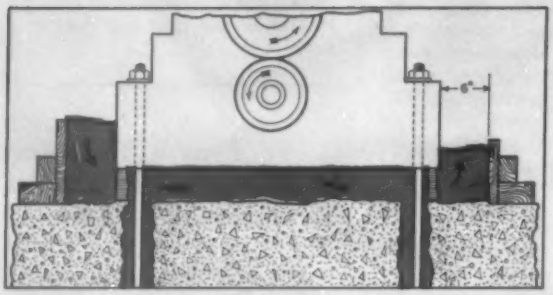


Fig. 1. GRAVITY GROUTING PLUS RODDING AND WORKING: This is the most common method of grouting. For good results grout must flow easily, rodding must be accurate, and grout must be worked into place as quickly as possible

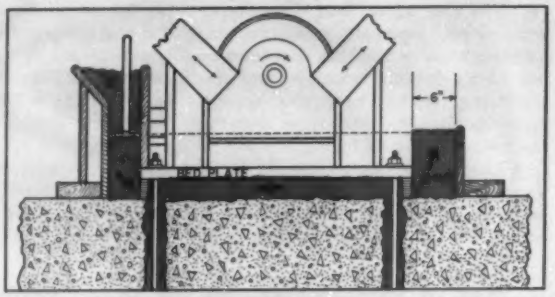


Fig. 2. WELL AND PLUNGER PRESSURE GROUTING FOR SOLID WIDE BEDPLATES: Good method where bedplates are over 10 ft wide. Grout must be able to flow from one side to the other without interruption. Secure forms are essential

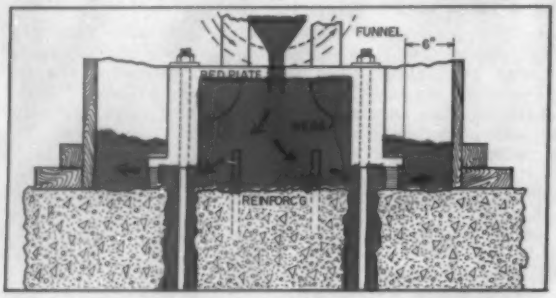


Fig. 3. DEEP GROUTING HOLLOW ENGINE BASEPLATES THROUGH CENTRAL HOLES: Once grout starts flowing out and around engine baseplates, dry sand may be put on grout to equalize pressure, save grout, and hasten finishing

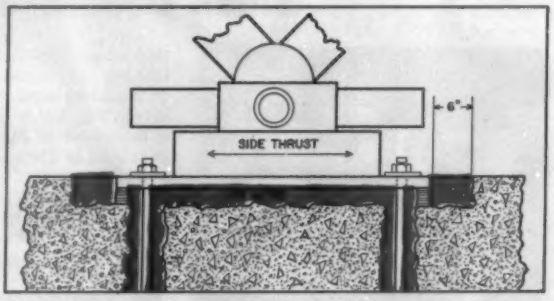


Fig. 4. FOUNDATION DESIGN FOR ENGINES WITH SIDE THRUST: Depressions in foundation give best results for engines with side thrust. Otherwise special shoulders have to be built up with reinforcing to give enough shear strength

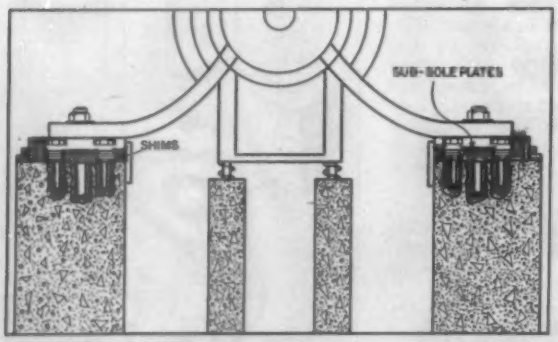


Fig. 5. ENGINES REQUIRING INDEPENDENT SOLEPLATES: When a machine requires limited freedom of movement in most directions, it is set on soleplates so that movement will take place between the metal surfaces of bedplate and soleplate and not between bedplate and mortar grout. Diagram above illustrates one method of grouting this type of soleplate

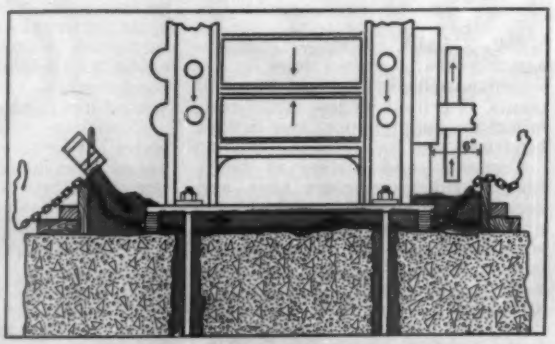


Fig. 6. REMOVING AIR POCKETS DURING GROUTING: ½ in. to 1 in. link chains (pump chain) placed under equipment at intervals before the grout is poured, and having wires attached to the ends as shown above, may be passed round anchor bolts, and if worked during grouting will greatly assist in eliminating air pockets and compacting grout

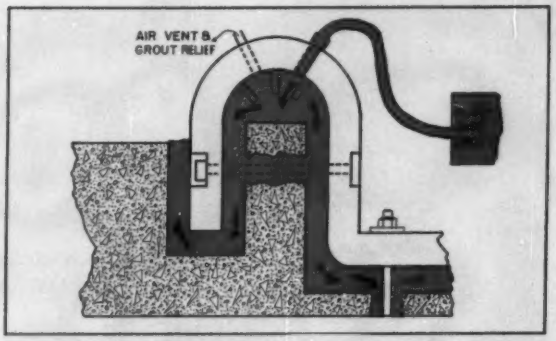


Fig. 7. PRESSURE GROUTING DIFFICULT RECESSES, SCROLL CASES, SPEED RINGS, ETC: Blow cases, as in Fig. 10, and pressure pumps are very useful for this kind of operation. Great care must be taken to keep grouting continuous, to avoid excessive pressure caused by stiffening of the grout

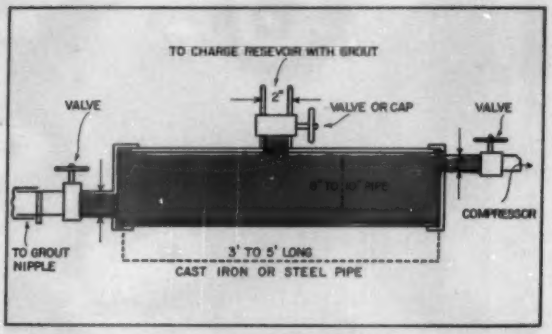


Fig. 8. BLOW CASING FOR PRESSURE GROUTING: Blow cases for forcing grout into position in the type of application shown in Fig. 9 can be made easily and cheaply with a length of pipe and a few valves and fittings as shown above. Control of air pressure by the operator is very important

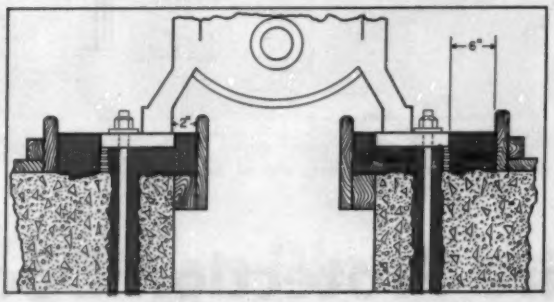


Fig. 9. SPLIT FOUNDATION WITH CLOSE CLEARANCES: Adequate clearance between forms and bedplates on the inside is essential to give access for proper compacting of grout. Overhanging grout may be removed after final set

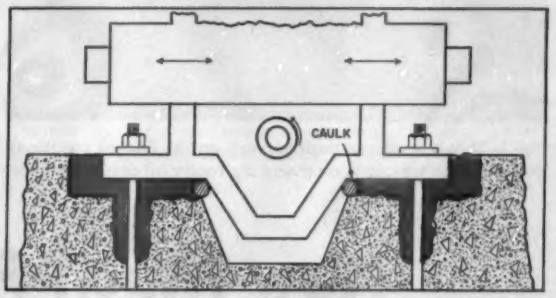


Fig. 10. BASEPLATE AND DEEP CRANKCASE GROUTING: With high operating temp the crankcase must be free to expand. Note caulking between foundation and upper portion of the crankcase to prevent grout running out beneath the case

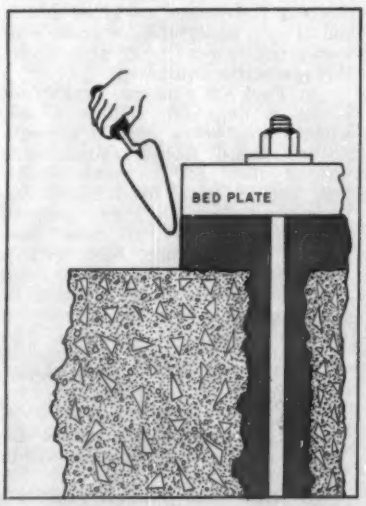


Fig. 11. FLUSH CUT FINISH: Type of finish most commonly used. Paint foundation where grout is to be removed with varnish or shellac before pouring to prevent grout sticking. Use good oilbase paint as finish on grout edge

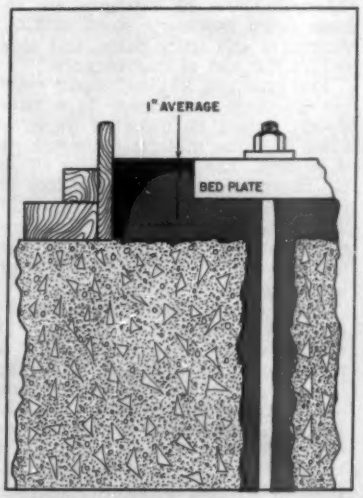


Fig. 12. SHOULDER CUT BACK: After the grout has set it may be cut back as shown above and replaced with ordinary finishing mortar, which gives a better wearing surface, with less powdering or chipping than exposed grout

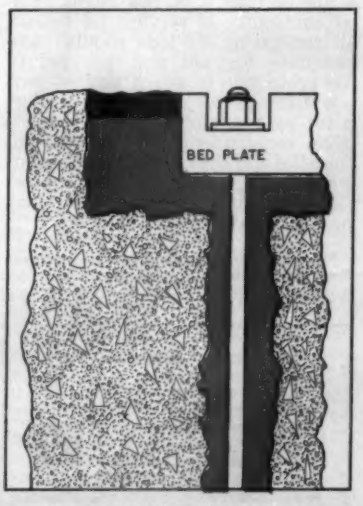


Fig. 13. SIDE THRUST: With the type of foundation shown above, used for machines having to stand large side thrusts, the top layer of grout is removed while still fresh and replaced immediately with a layer of finishing mortar

Fig. 1. Shows what can happen very easily. Part of electrical gallery after serious fire caused by faulty oil circuit breaker

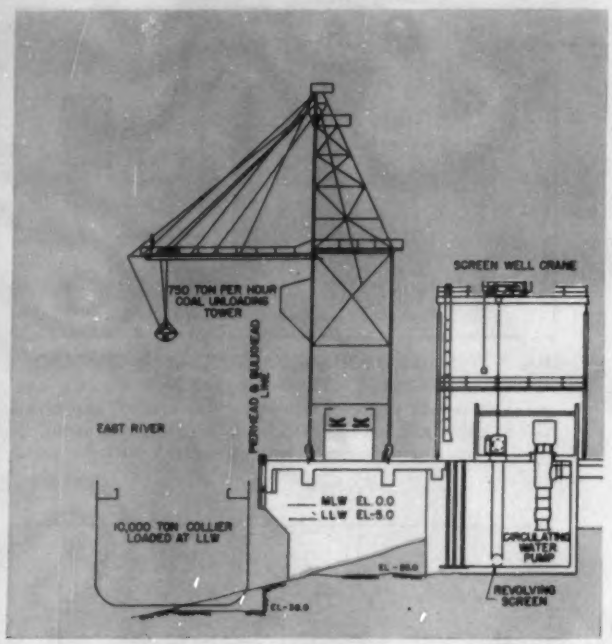


Fig. 2. Part of power plant shown in Fig. 3. Anti-freeze outdoor type extinguishers should be used in these areas

How Much Fire Protection Does

By W. E. ROSSNAGEL*

AMOUNT OF FIRE protection needed for a modern power plant depends largely on the possible effect a fire in vital locations might have on continuity of service. Of course, all generating stations should have adequate first-aid and heavy-duty fire protection to guard against serious damage or destruction of the plant by fire, and to meet the minimum requirements of the local authorities and the fire insurance underwriters, but this general fire protection should be supplemented by extra protection at strategic locations.

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About the Author

W. E. Rossnagel, well-known for his writings on fire protection and safety, is a consulting engineer specializing in the fields of safety and fire protection. In this capacity he is employed by Consolidated Edison Co. of New York to supervise their safety and fire protection programs. He has written a Handbook of Industrial Fire Fighting for Con Edison, and in recent years he has contributed numerous articles to the technical press, including POWER ENGINEERING, on the subjects of safety and fire protection.

There should be a minimum of one standard size fire extinguisher of appropriate type for every 2500 sq ft of floor area. An attempt should be made to limit the number of different types of extinguishers to keep down necessary stock of CO_2 cartridges and spare parts, and also reduce the cost of maintenance.

For example, 2½ gal water type extinguishers (anti-freeze type outdoors) should be installed where a Class A (solid material) fire hazard is evident. For protection for Class B (flammable liquid) and Class C (electrical) fires 15 lb CO_2 and 20 lb dry chemical fire extinguishers are most satisfactory. This limits the first-aid fire protection to three or four types.

There may be places within the station where the amount and type of supplementary fire protection are a matter of opinion or judgment; for instance, a large transformer on one of the cross-country feeders. Usually fixed fire protection should be installed for such transformers, but if there are parallel feeders, each capable of carrying the entire load, then the outage of one transformer after a fire may not interrupt service, and the company engineers may be willing to take the gamble and not install any special fire protection.

Figs. 2 and 3 show cross-section of a modern power station of 380 mw capacity. The letters, with their arrows, indicate the locations where special fire hazards may be found. Below are suggestions for supplementary fire protection for such hazards. References are given at the end of each paragraph for those who wish to obtain more information about this protective equipment.

(A) **Fuel Oil Storage Tanks** (*not shown in diagram*). Bunker C oil, when stored below ground presents no fire hazard. Above ground tanks located close to the main buildings should have fixed foam systems installed. At an isolated location, two 2½ in. hose lines from a fire hydrant, each with a mechanical foam proportioner, and with portable foam towers should be adequate protection for a group of oil tanks. (See Handbook of Fire Protection, 11th edition, Chap. 10 & 61) by National Fire Protection Association, 60 Batterymarch St., Boston.

For the rest of this article the Handbook of Fire Protection will be abbreviated HFP.

(B) **Raw Coal Bunker.** Provide a standpipe outlet, piped to a 1½ in. cartridge type wet water proportioner mounted on the building wall nearby, and the necessary length of 1½ in. cotton rubber-lined fire hose with a shut-off type nozzle. (HFP Chap. 10 & 65.)

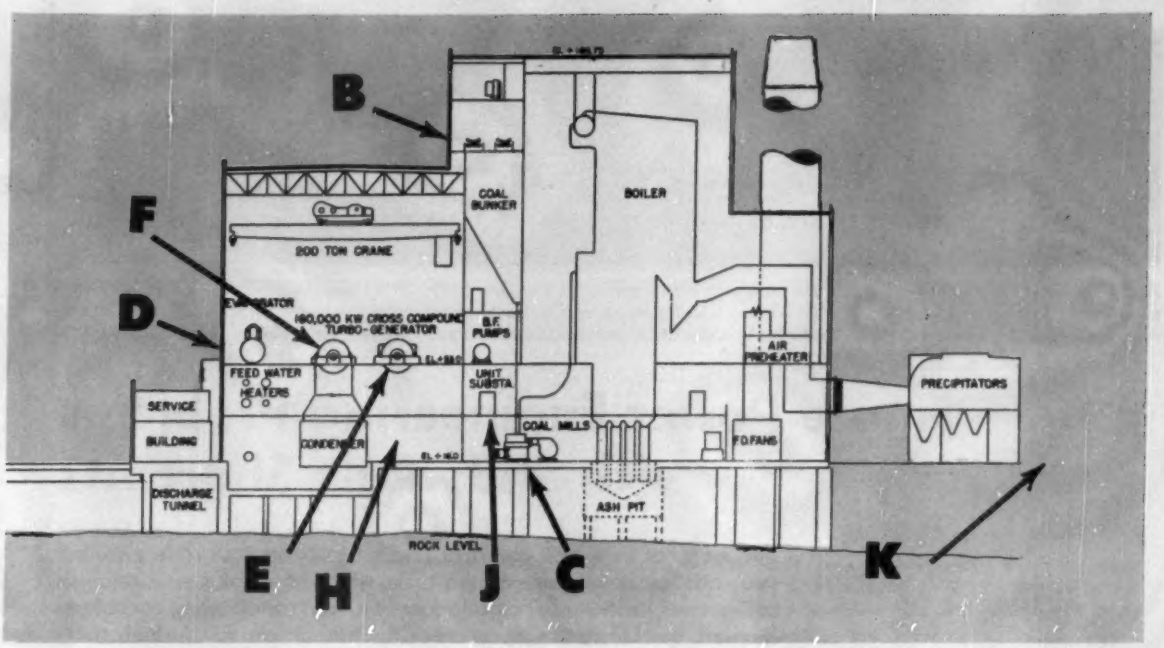

Fig. 3. Sectional elevation of modern 350 mw power plant. Good fire protection consists of general protection supplemented by extra protection at strategic locations. Letters show these locations. Equipment required is detailed in text

A Power Plant Need?

(C) **Coal Pulverizers.** Install standpipe outlets in the mill room with 1½ in. fire hose and fog nozzles. (HFP, Chap. 10 & 63.)

(D) **Turbine Room.** Install standpipes with 1½ in. hose and with fog nozzles of a type which (as designed or as altered) cannot discharge a solid stream of water. (HFP, Chap. 10 and 64.)

(E) **Turbine Oil Piping:** These recommendations apply to oil piping adjacent to high temp steam piping below the turbine. Install a fixed water spray or fog sprinkler system which is automatically or manually controlled. Where the cost of such a system cannot be justified an alternate scheme may be acceptable. About 12 in. below the ceiling (the under side of the turbine room floor) install a 2 in. pipe with four to eight 212 deg "fog" type sprinkler heads mounted on it, and provided with a 2½ in. female fire hose coupling above the floor. In event of a fire in this area the 2½ in. hose from the standpipe can be connected to this dry sprinkler pipe, and the water turned on. When the ambient temperature below the floor reaches 212 deg or higher one or more sprinkler heads will fuse and cause the water to be discharged as a fog. These finely divided water particles, coming into contact with the heated air, will be instantly converted into steam. Each head can thus produce up to 4000 cfm of steam which should control or extinguish the fire with a minimum of water damage. (National Fire Protection Association Quarterly, January 1954, & HFP, Chap. 64.)

(F) **Generators:** The newer turbine generators are hydrogen cooled, and have CO_2 piped for purging. This CO_2 can be quickly discharged into the generator in event of a fire. Older generators may be equipped with circular perforated piping inside the end-bells, with a 2½ in. female hose coupling at a convenient location to which a standpipe hose may be coupled in event of a fire in the machine. (HFP, Chap. 10, 62, 63 & 64.)

(G) **Hydrogen Apparatus and Storage** (*not shown in diagram*). Standpipe outlets with 1½ in. fire hose and fog nozzles. (HFP, Chapter 64.)

(H) **Turbine Oil Room:** Automatic sprinkler system with 212 deg fog type sprinkler heads is recommended. Fire doors should close automatically. (HFP, Chap. 29 & 64.)

(I) **Fuel Oil Room:** (Same as for turbine oil room.)

(J) **Electrical Galleries:** Provide supplementary protection for use after the equipment has been deenergized. Recommend one or more wheeled type pressurized water-fog extinguishing units of 20 gallons capacity. (See HFP, Chap. 10 & 64.)

(K) **Large Transformers:** Automatic controlled water spray protection. (HFP, Chap. 10 & 64.)

At strategic locations throughout the station install wheeled CO_2 and dry chemical extinguishers. A system of fire alarm signals is necessary, and a well-trained fire brigade should be organized on each watch.

Fire *protection* also includes fire *prevention*. Explosion-proof (as distinguished from vapor-proof) electric fixtures should be installed in oil rooms, near the coal pulverizers, near the hydrogen apparatus and in other hazardous locations. The use of low flashpoint solvents should be restricted, if not prohibited, for such jobs as degreasing machinery, cleaning insulators, switch contacts, motor windings, etc.

Even though the above fire protection against a turbine oil fire, is provided, it is still remotely possible to have a fire of serious proportions. To prevent the accumulation of superheated air under the turbine room roof, which might cause collapse of the roof trusses, it is important to provide adequate ventilation for the upper part of the turbine room. Also, thought should be given to the protection which might be afforded the exposed structural steelwork by coating it with fire retardant (not fire resistant) paint.

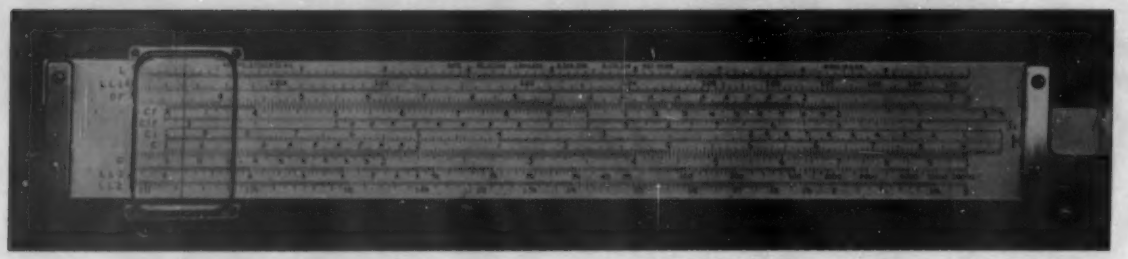

Fig. 1. Converting ultimate or proximate analysis with 9 per cent moisture to the dry basis: Move C scale 9 hundredths to the right to obtain common multiplier 1.1 on D scale. Move hairline to intersect each "wet" percentage on the C scale, then read the "dry" percentage on the D scale. Operation on rule above is converting W_{da} from wet basis to the dry basis

Figure Power Engineering Problems with Slide Rule Shortcuts

You may not think you can add and subtract on your slide rule, but you can. This is only one of the tricks which can make your analysis conversions, efficiency calculations or air conditioning problems simpler, quicker, more accurate. Clip this article for further study

By PAUL J. GROGAN *

BUDDING engineers take great pride in the ownership of their first K & E Log-Log Duplex Decitrig or its equivalent. However, many lose valuable years before learning how to obtain the maximum use of the C and D scales. The fault may well be that proper instruction in the manual art is generally unavailable. Herein are described methods which should become common knowledge among students and practicing engineers.

The statement is often made, "you can do nearly everything with a slide rule except add and subtract." To contest this general belief, reference is made to a general class of mathematical operation which recurs frequently. A typical example is the instance of converting a coal analysis from an *as-received* to a *moisture-free* or a *moisture-and-ash-free* base, where advantage may be taken of a time-saving technique with a slide rule which embodies subtraction as well as division.

The object is to find a Z (an unknown) for the new base, commonly *dry* and/or *combustible*, through use of the following:

$$Z_{(dry)} = \frac{Z_{(as\ rec'd)}}{1 - W_{(as\ rec'd)}} \qquad (1)$$

and

$$Z_{(comb)} = \frac{Z_{(as\ rec'd)}}{1 - (W + A)_{(as\ rec'd)}} \qquad (2)$$

where W and A are the decimal fractions of moisture and ash respectively in the as-received coal analyses, both proximate and ultimate, and Z is any other property of the fuel appearing in the following list:

- C is the decimal fraction of carbon in the ultimate analysis
- H is the decimal fraction of hydrogen in the ultimate analysis
- O is the decimal fraction of oxygen in the ultimate analysis
- N is the decimal fraction of nitrogen in the ultimate analysis
- S is the decimal fraction of sulfur in the ultimate analysis
- A is the decimal fraction of ash in either the proximate or the ultimate analysis
- W is the decimal fraction of surface moisture in either the proximate or the ultimate analysis
- FC is the decimal fraction of fixed carbon in the proximate analysis
- VM is the decimal fraction of volatile matter in the proximate analysis
- HHV is the higher heating value of the fuel in Btu per pound
- W_{th} is the pounds of theoretical air required per pound of fuel
- W_{xa} is the pounds of excess air supplied per pound of fuel
- W_{da} is the actual pounds of dry air supplied per pound of fuel
- H′ is the decimal fraction of free, combustible, or available hydrogen in the ultimate analysis. H′ = (H—O/8)

Ash as might appear in determining combustible base properties may be interpreted as being "the pounds of ash associated with one pound of combustible. Similarly, moisture as determined for either the dry or the combustible base may be interpreted as being, "the pounds of surface moisture associated with one pound of either the dry coal or the combustible."

Given the following as-received coal analyses, and assuming combustion in 20 per cent excess air, it may be desired to find all of the foregoing properties for the moisture-free and the moisture-and-ash-free bases:

Proximate Analysis	*Ultimate Analysis*
FC—50 per cent	C —66 per cent
VM—30	H 4
A—11	O — 8
W— 9	N — 1
—	S — 1
100 per cent	A —11
	W— 9
Higher Heating Value	—
11,500 Btu per pound	100 per cent

Simple standard calculations in terms of the data above will reveal the following additional properties about the fuel:

H′ =3%	W_{th}= 8.73
W_{xa}=1.75	W_{da}=10.48

To convert these fourteen distinct items to a new base requires fourteen separate slide rule operations for the beginner. Furthermore, he must first carry out the subtractions indicated in Equations (1) and (2). A wiser hand learns to find the reciprocal of the functions represented by the denominator in either of the equations above and uses it as a constant multiplier in each of the several operations.

The method proposed herein is one of finding the proper reciprocal function at the same time the indicated subtraction takes place, *and the slide rule is to do all the work.*

If the C-scale of the slide rule were to read from right to left, as well as from left to right, a provision comparable to that which is made for reading the S-scale, our operations would be simplified. We can simulate such an operation, however, by counting spaces from right to left.

Since this initial discussion centers around percentage determinations, the C-scale is assumed to be divided into hundredths between 0.10 and 1.00. Also, this proposal is *not* a reciprocal scale as evidenced by the

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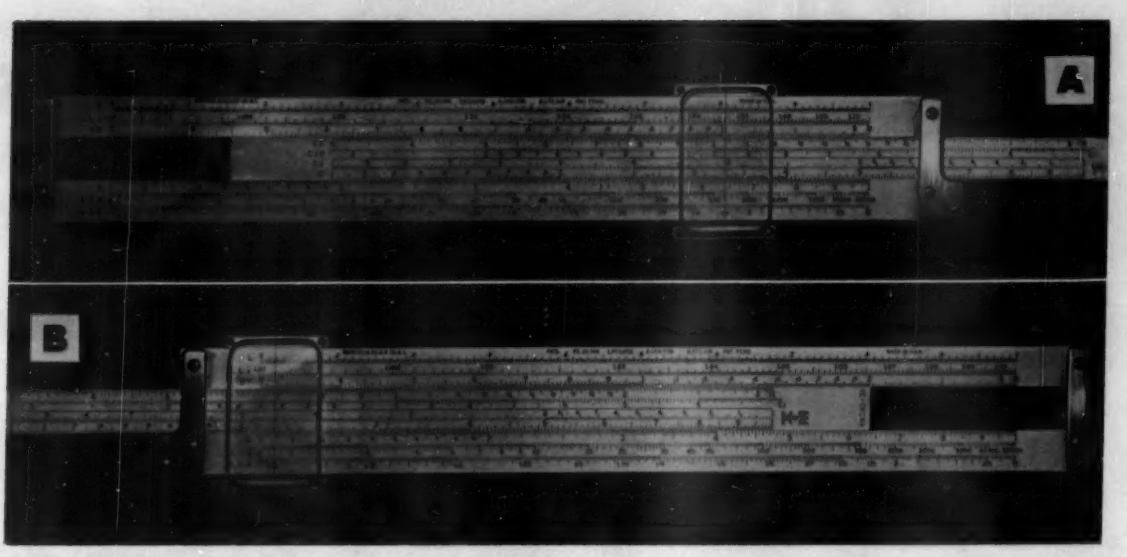


Fig. 2. To find $7^{0.33}$, set the C index on 7 on the LL3 scale, then move the hairline to 0.33 on the C scale. Read the result (1.9) on the LL2 scale. To find the reciprocal of 1.9, set hairline over 1.9 on the C scale, read 0.526 on the CI scale. Second photo shows 0.526 being subtracted from 1.0 by moving C index 0.526 from the right. Answer is 0.474 on D

obvious disagreement with the CI-scale which generally appears directly above the C-scale. Rather, this scale represents the function (1.00 – "C"), where "C" is the real C-scale value in the range 0.10 to 1.00. In this sense it is comparable to the S-scale which may be read from right to left for angles represented by the function (90 – x), where x is read conventionally from left to right.

If the moisture in the fuel is 9 per cent as reported by the analyses, simply slip the C-scale 9 hundredths to the right over the index of the D-scale. In this movement, you have in reality subtracted 0.09 from 1.00 and have therefore set 0.91 over the right index of the D-scale (see Fig. 1). *This much accounts for the subtraction!* Now, look to the left index of the C-scale which is automatically set over the reciprocal of (1 – W) and the rule is in readiness for the various multiplications necessary to determine the moisture-free properties. In this procedure, move the hairline across the rule from left to right but once, reading in succession:

$S_{(dry)} = 1.1$	$HHV_{(dry)} = 12{,}600$
$A_{(dry)} = 12.1$	$VM_{(dry)} = 33.0$
$H'_{(dry)} = 3.3$	$W_{da(dry)} = 11.51$
$N_{(dry)} = 1.1$	$W_{2a(dry)} = 1.92$

Decimal places are readily determined by inspection in each instance. For combustible-base calculations, move the C-scale to the right (W + A) or (9 + 11) hundredths over the D-scale index. Again, the function 1 – (W + A) = 0.80 appears at the right index of the D-scale. Its reciprocal, 1.25, is in readiness as a multiplier at the left index of the C-scale.

Two advantages of the method in operations of this nature are increased *speed* and *accuracy*. Just one slide rule adjustment is made. Therefore, it can be made with utmost precision. Any minor difficulty experienced in getting the various percentages to total 100.0 or 100.00 may be overcome by making the necessary change in the carbon and/or fixed carbon values. The relative change in these larger items due to a small discrepancy will have little affect upon the significance of the values so obtained.

Such a method may well be extended into additional classes of problems involving the elimination of one or more items from a group with the expression of the remaining items in terms of the whole or in terms of 100 per cent. By now you have probably thought up your own application whether it be a problem in chemical mixtures, such as gases where one constituent may be absorbed or condensed out; physical mixtures such as concrete aggregates where a minor constituent is added or removed to improve properties.

Another example involving a combustion application is that of expressing the dry flue gases after having calculated the composition of the mixture with the water vapor included. Here again,

$$Z_{(dry)} = \frac{Z_{(wet)}}{1 - H_2O_{(wet)}} \qquad (3)$$

where Z is now the per cent of any other dry gas such as CO_2, CO, O, SO_2, or N_2, and H_2O is the decimal fraction of the water vapor in the wet gases. Calculations may be upon either the volumetric base or the gravimetric base.

A very similar problem arises in the solution of heating, ventilating, and air conditioning problems involving "dry air" as contrasted with the usual conditions of observation where a variable amount of water vapor is present in the air handled.

The same technique may also be used in going from any of the various dry bases back to a wet base. Assume a moisture-free coal analysis is known and it is further ascertained that the coal is being fired with 7 per cent moisture. The function then becomes:

$$Z_{(as\ fired)} = Z_{(dry)} \times (1 - W)_{(as\ fired)} \qquad (4)$$
$$Z_{(as\ fired)} = Z_{(dry)} \times (1 - 0.07)$$

Now, move the C-scale to the left 7 units. The right index is over 0.93, and the multiplication operation may begin at once. Any of the various Z's may be determined after this one adjustment. Also, you will soon learn to make the proper setting without any conscious effort of subtracting as required by Equation (4).

The advantage is even greater if given a similar problem with a moisture content of, say, 11.29 per cent. You are skilled in setting your slide rule index at 0.1129 on the left. Try it on the right! It will save you subtracting 0.1129 from 1.0000 to obtain 0.8871. After practicing these methods, 0.1129 is just as easy to locate as 0.8871 and you will spare yourself the subtraction.

Consider the equation for the ideal thermal efficiency of an Otto-cycle engine. Assume a compression ratio of 7 to 1 and a specific heat ratio of 1.33.

where,

$$e_I = 1 - \frac{1}{r_k^{k-1}} \qquad (5)$$

e_I = ideal thermal efficiency
r_k = volumetric compression ratio = 7 (given)
K-1 = a specific heat function = 0.33 (given)

In effecting a solution, evaluate $7^{0.33} = 1.9$ on the log-log scales (see Fig. 2A). The reciprocal (CI) scale may be used to find 1/1.9 = 0.526 on the C-scale. The solution calls for the function (1 – 0.526). The tech-

nique of reading the C-scale from right to left (Fig. 2B) gives the ideal thermal efficiency at once as being 47.4 per cent. Two adjustments of the rule have solved the entire problem.

The practice of arriving at the efficiency in terms of the losses becomes almost a necessity when attempting to define conditions very near to 100 per cent. Imagine the problem immediately above, excepting that the losses are now merely 49 Btu. Attempts to determine the efficiency by expressing the ratio 3364/3413 are awkward to adjust and difficult to read accurately beyond two places. The per cent losses are easy to determine to three or four places, however, from the ratio 49/3413, or 1.436 per cent. It requires very little additional effort now to express the efficiency to three and four places with confidence. With practice, this may be left up to the slide rule. Recognizing that the losses are in the general range of 1 per cent to 10 per cent, the efficiency is in the complimentary range of 90 per cent to 99 per cent. The D-scale may then be read from right to left by counting spaces. The per cent efficiency in the example is read to five significant figures. The answer approaches a desk calculator result for its general utility.

For power plant design engineers, the prediction of the steam generator efficiency, η_{sg}, usually precedes the sale, manufacture, and erection of the unit. This procedure assumes the combustion of a unit weight of the typical fuel to be used and a calculation is made of the various Btu losses up the stack, to the ashpit, and away from the unit by radiation, conduction, and boiler blowoff. The efficiency is then estimated in terms of:

$$\eta_{sg} = 100 - \Sigma \text{ (Per cent Losses)} \quad (6)$$

Assuming a 12,600 Btu per pound coal and summarized losses of 1683 Btu per pound of fuel, the losses are determined at once as being 13.37 per cent. More important to utility executives, however, is the steam generator efficiency. It may be read with ease from the same setting as being 86.63 per cent.

Mechanical engineers should also learn to work with relatively high quality steam in terms of "per cent moisture" rather than the more common "per cent dry steam." The properties of the dual phase are generally very much easier to obtain in terms of the moisture traces present. Assume the academic problem of obtaining the enthalpy, specific volume and the entropy of saturated steam at atmospheric pressure (14.696 psia) and 98.73 per cent quality. The usual procedure in solving this problem is to apply the following formulas which may be found in any discussion of the properties of steam:

$$h_x = h_f + x h_{fg} = 180.07 + 0.9873(970.3) \quad (7)$$

$$v_x = v_f + x v_{fg} = 0.01672 + 0.9873(26.78) \quad (8)$$

$$s_x = s_f + x s_{fg} = 0.3120 + 0.9873(1.4446) \quad (9)$$

The seemingly-impossible task of maintaining the four and five significant figures of the given data may be overcome by working from the "vapor side" of this problem. The point 0.9873 (counting from the right) coincides with 0.0127 on the real scale and the function "decimal fraction of moisture" equals "1.0000 minus decimal fraction of dry steam" is solved:

$$h_x = h_y = h_g - y h_{fg} = 1150.4 - 0.0127(970.3) \quad (10)$$

$$v_x = v_y = v_g - y v_{fg} = 26.80 - 0.0127(26.78) \quad (11)$$

$$s_x = s_y = s_g - y s_{fg} = 1.7566 - 0.0127(1.4446) \quad (12)$$

In the equation above, $y = (1 - x)$ = the decimal fraction of moisture in the dual phase. The points x and y are synonymous and have but a single set of properties. Hence the properties at the point may be determined with either set of equations.

The solutions of Equations (7) through (12) are left as an example for the reader. The ease of obtaining three, four, and five significant figures in the latter examples is ample testimony of the advantages of these handy calculating methods.

Permanent Magnets Do the Job in Pipeline Trap

NEW TYPE of permanent magnetic pipeline trap for removing iron fines and tramp iron from practically any kind of liquid material is now available.

This trap may be used in lines handling water . . . oil . . . brine . . . chemicals . . . coolants, as well as by processors of food products, petroleum products, bottled goods, and products made from clay.

Magnetic strength of these traps are derived from elements of powerful Alnico V, the magnetic efficiency of which is guaranteed to maintain itself indefinitely. Periodic removal of iron accumulations — the only maintenance required — is fast and simple. Multiple magnetic elements, contained in stainless steel tubes, are so positioned within the trap that material is caused to flow in thin streams, and in variously changed directions, over the whole length of the magnets so that even very fine iron is readily captured and retained by the powerful magnetic fields. There is no restriction of flow through the trap; in operation, iron accumulation tends to work around to the downstream side of the tubes where it offers no interference to flow, and where it is doubly secure against being dislodged even by relatively high velocity materials. The magnetic tubes are mounted as an integral part of the cover, hence are removable for cleaning by simply loosening the closure and withdrawing the entire assembly. There are no loose parts to misplace. Cover closes against a Neoprene gasket and will readily operate at pressures up to 150 psi. The trap may be installed with the cover plate up, down, or on either side, or as part of a vertical pipeline, with no variation in operating efficiency.

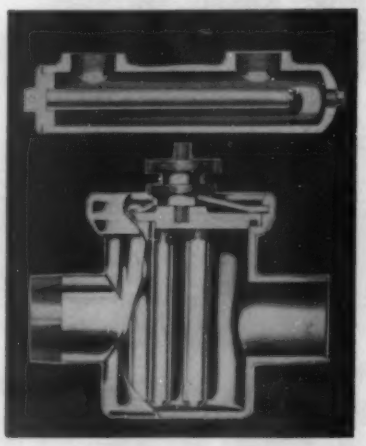
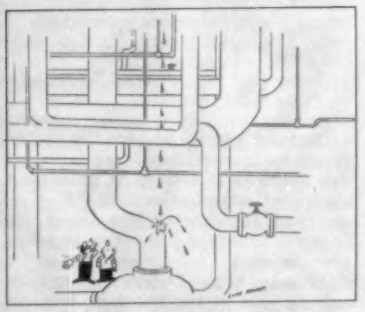


Fig. 1. Two types of trap described in text. Alnico magnets last indefinitely

Write MAGNETIC TRAP on the prepaid postcard elsewhere in this issue and mail it to us if you want more information on this type of trap



"Oh no—not again—the water was up to our hips the last time—before we found it!"

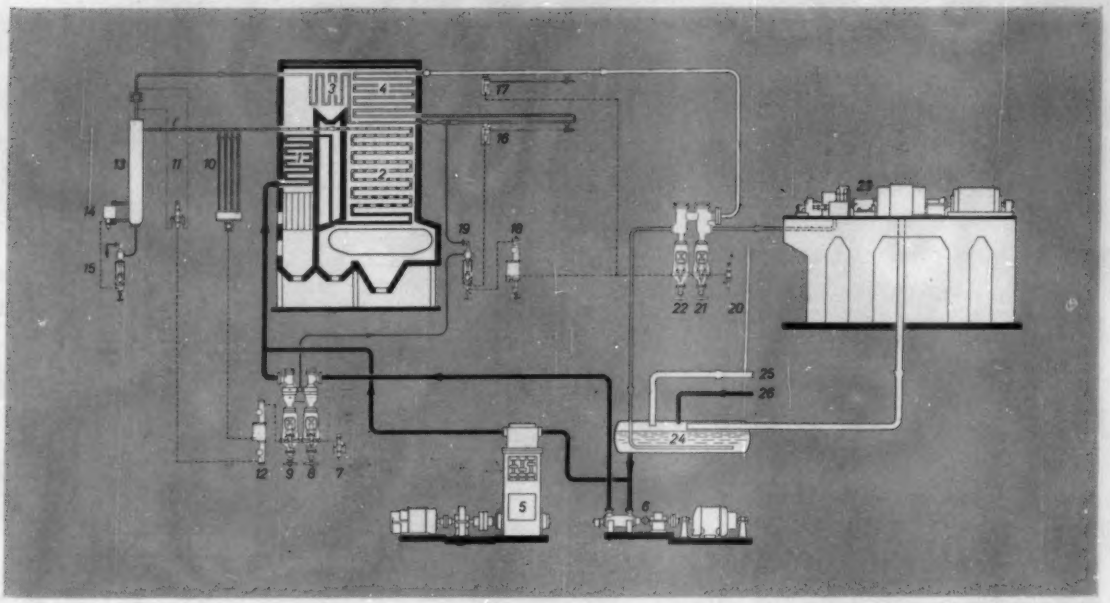


Fig. 1. Basic control diagram for a power plant using high-pressure monotube steam generator of type described in text

1 Economiser
2 Evaporator
3 Superheater
4 Final superheater
5 Piston-type feed pump
6 Standby feed pump
7 Pressure difference receiver
8 Differential pressure regulating valve
9 Feed regulating valve
10 Selector thermostat
11 Pressure difference receiver
12 Isothermal regulator for feed water
13 Water separator
14 Water level receiver
15 Blow-down valve
16 Thermostat
17 Final thermostat
18 Isothermal regulator for injection
19 Injection valve
20 Steam-pressure receiver
21 Main steam valve
22 Bypass valve
23 Back-pressure turbine set
24 Starting reservoir
25 Pipe to steam transformer
26 Condensate return line from steam transformer

Control for An Industrial Monotube Boiler

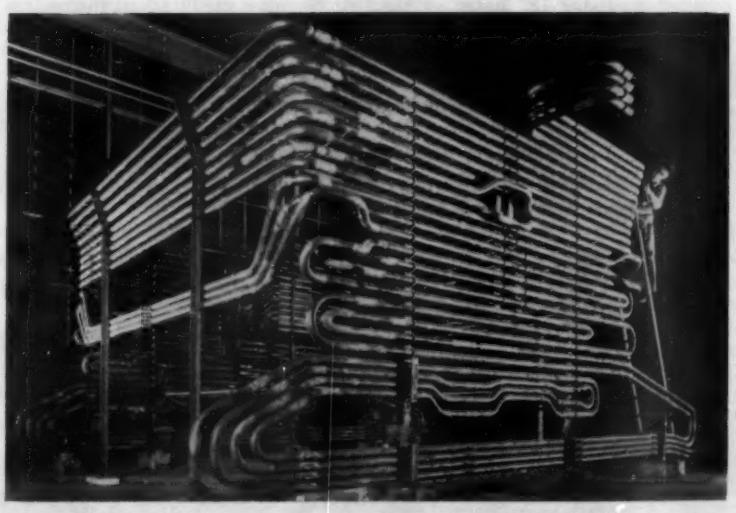


Fig. 2. Shop assembly of combustion chamber for h-p monotube steam generator

ABOUT TWO AND A HALF years ago, a French chemical manufacturing company put into service an 88,000-lb-per-hr Sulzer monotube boiler in one of their factories at Feuchy-les-Arras, France. Since then this boiler has given excellent service, and has exceeded its guaranteed efficiency. It is equipped with an automatic control system, details of which are given below.

The boiler generates steam at 1560 psi and 932 F, and the combustion chamber, which is fully lined with cooling tubes, is designed to burn mixed fine coal with an ash content up to 36 per cent. Figure 2 shows part of the evaporator system for the combustion chamber being assembled in the shops. Fuel is fed through oscillating chutes into hopper of a traveling chain grate stoker.

Primary purpose of the station is to supply processing steam for the factory. A 4500-kw back-pressure turbine generator is used to reduce the steam pressure from 1560 to 256 psi and 128 psi. From the turbine the 128 psi steam is taken to a steam transformer and reduced to 92 psi for process use.

Figure 1 shows the basic control diagram for a back-pressure plant using a monotube boiler. Operation,

Fig. 3. View of piston-type variable-speed feed pump for monotube boiler

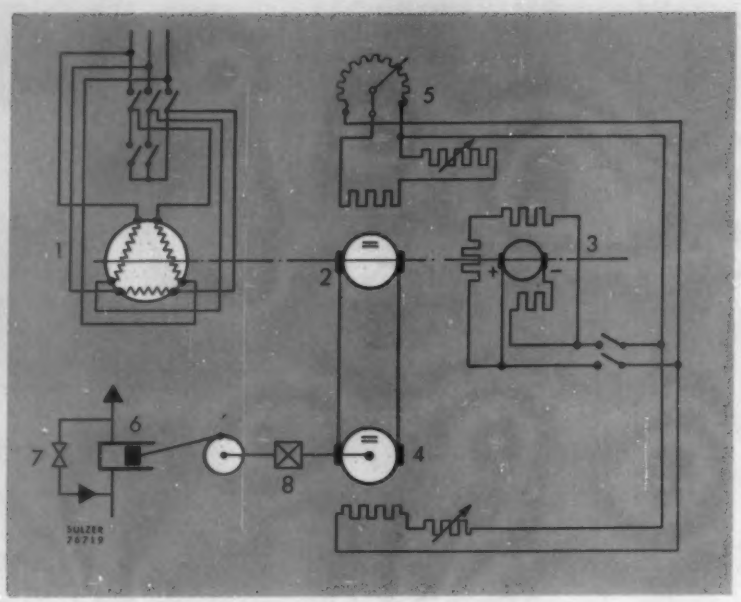


Fig. 4. Diagram of Ward-Leonard driving set for feed pump shown in Fig. 3. Feed water flow is regulated so end of evaporation occurs at same place at all loads

1 Slip-ring motor with double-slotted rotor for three-phase current of 50 cycles, 3000 V

2 Variable-voltage d.-c. generator

3 D.-c. exciter

4 Variable-speed d.-c. motor

5 Adjustable resistance for generator exciter. The speed is adjusted exclusively through the 100-step resistance 5. Speed adjustment per step: 0.75%. Resistance is changed by a rotary servo-motor, receiving impulses from the automatic boiler control system.

6 Piston-type feed pump, max. speed 180 r.p.m., min. speed 45 r.p.m.

7 Starting bypass (the valve is open during starting)

8 Reduction gear between motor and pump

as described in *Sulzer Technical Review* No. 2, 1954, is as follows:

Piston-type pump 5 draws the feedwater from starting reservoir 24 and delivers it through economiser 1 to evaporator 2 in the combustion chamber, bypassing the feed station 8 and 9. The flow of feedwater is regulated so that the end of evaporation is kept at the same place at all loads. The residual moisture at the outlet from the evaporator is eliminated, with the salts it contains, in separator 13, which is connected to an automatic blow-down 14 and 15.

The saturated steam is next brought up to the desired steam temperature in superheater bank 3 and final radiation superheater 4. The pressure regulating station is located at the outlet from the boiler. It conducts the mixture of steam and water during the starting period (or, after any failure of the turbine, the superheated steam) through bypass valve 22 into starting reservoir 24. In normal service, however, the steam flows at 1560 psi and 932 F through main steam valve 21 to back-pressure turbine 23. Here it is expanded and then used for producing secondary steam in a steam transformer. The condensate on the primary side returns to starting the reservoir 24 and thus closes the primary cycle.

Rate of flow of the feedwater is controlled primarily by the steam temperature at the evaporator outlet. Multiple thermostat 10 converts this temperature into a proportional oil pressure, which acts through isothermal regulator 12, adjusting the rheostat and thus the speed of the motor driving the feed pump. To ensure that the water flow is at once adapted to any rapid and marked alteration in the intensity of the fire, a second signal is taken from the steam quantity leaving water separator 13.

When standby centrifugal pump 6 is in service, the feedwater flows through differential pressure regulator 8, which throttles the pump pressure to the boiler inlet pressure corresponding to the load, and through feed regulator 9, which adjusts the flow of water and is controlled by the two signals mentioned above. The regulation of the steam temperature at the superheater outlet is effected by two thermostats 16 and 17 which are placed before and after the final superheater and act in concert on injection valve 19. The signal from final thermostat 17 is passed through an isothermal regulator 18 to permit the final steam temperature to be kept stable and constant within very narrow limits even when big changes of load occur.

The boiler feed pump is illustrated in Fig. 3. The choice of a reciprocating pump in an industrial power station is justified by the facts that such pumps easily adapt themselves to pronounced fluctuations of load and can be operated with an efficiency of over 80 per cent over the whole load range. The speed of the pump is controlled by a Ward-Leonard driving set. Basic diagram of this set appears in Fig. 4. The slip-ring motor 1 with double-slotted rotor is fed with three-phase current of 3000 v and drives the direct-current variable-voltage generator 2 with the exciter 3. The potentiometric exciter resistance of the generator has 100 steps, each step representing a change of speed of 0.75 per cent. The resistance is changed by a rotary servo-motor, which receives its impulses from the automatic boiler control system. The speed of the pump set can be regulated at a ratio of 1:4. The direct-current motor 4 drives the pump shaft through reduction gear 8. A centrifugal pump without speed adjustment is available as a standby for the boiler feed; it is controlled by valves 8 and 9, Fig. 3.

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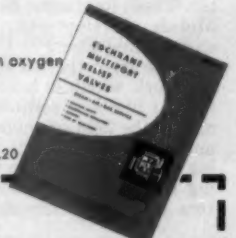

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Fig. 1 The Babcock & Wilcox Research Center at Alliance, Ohio

Fig. 2 (Left) The Creep and Stress Rupture Laboratory comprises 136 stations where tests are conducted to investigate the long-time behavior of alloys under stress and high temperature

B & W Shows Research Center

ON MAY 17TH, the Babcock & Wilcox Co. held an all-day Press Party for a group of 25 industrial and technical magazine editors at its Research Center at Alliance, Ohio. This great research laboratory is engaged in the development of new products and processes, as well as in the improvement of the established products of the company. The day, therefore, afforded the editors an unusual opportunity not only to inspect all the various divisions of this center but also to discuss the work that is being done there with specialists in each branch of the industry. After an all morning tour of the facilities, the afternoon was given over to lectures on each of the four major categories of work at the center. These four were: Steam research, Metals development, Combustion, and Atomic Energy.

Aside from the extremely interesting work which is being done in the field of fuel and combustion research and in the field of chemistry of water and steam, two of the most interesting divisions were the welding building and the alloy foundry. The visitors were given demonstrations of a newly developed automatic submerged arc welding process which deposits metal five times faster than present automatic welding machines. Where ordinary welding processes deposit only 30 lb per hr, this new process deposits from 150 to 180 lb per hr.

In the alloy foundry, the experimental work in the development of new high temperature, high strength steels was shown. In one program extending over a two-year period more than 245 different alloys were prepared and thousands of hours spent in testing them.

The pictures on this page show only a few of the many shops and experimental setups at the Alliance Research Center.

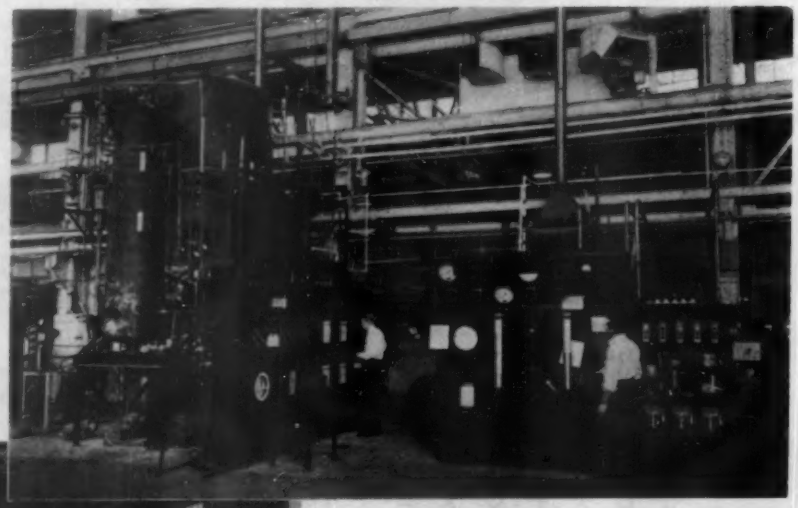
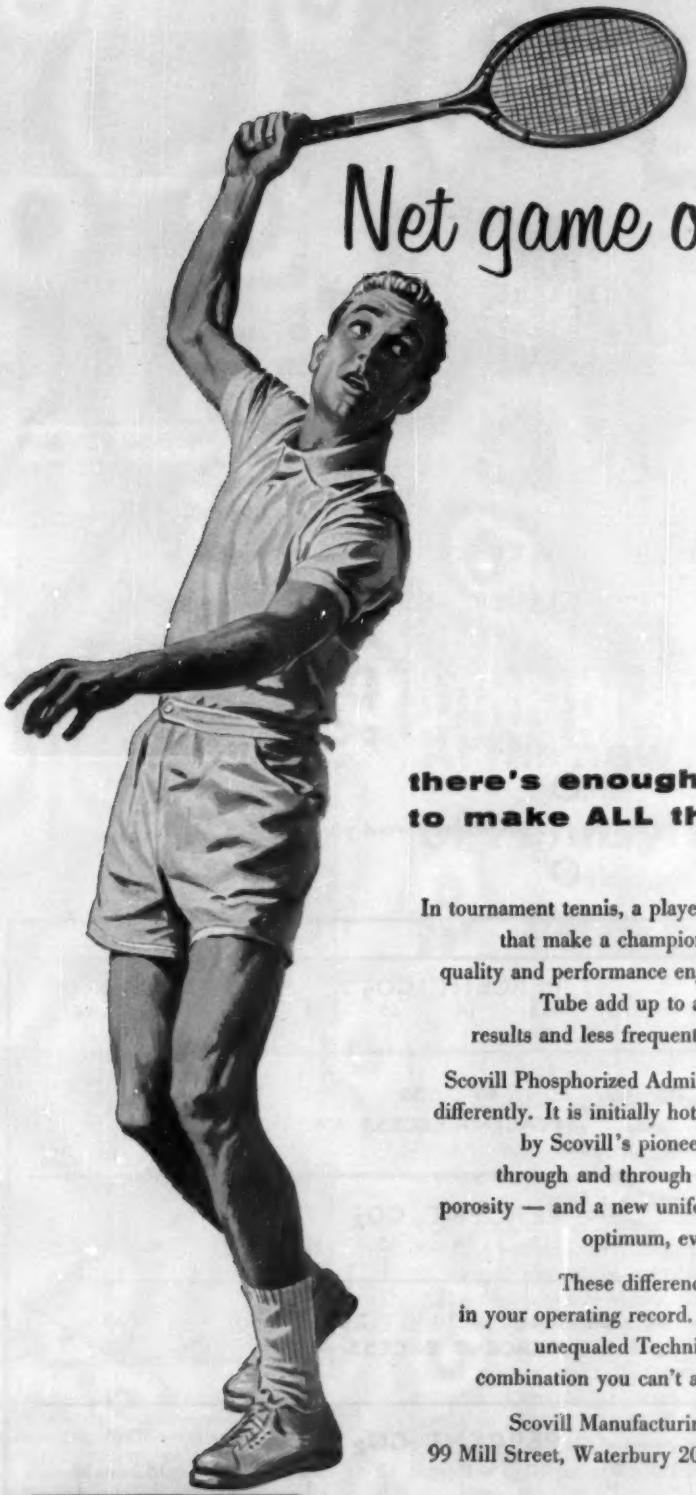


Fig. 3 (Above) This above-critical Test Unit provides a means for investigating conditions that exist in a boiler operating at pressures above the critical pressure

Fig. 4 (Left) A general view of the Welding Laboratory at the Babcock and Wilcox Company Research Center at Alliance, Ohio



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Power Engineering handbook

Know How to Relate Flue Gas CO_2, Excess Air and Efficiency

By R. R. TAGGS, E.E.

MANY operating engineers are directly responsible for the successful and efficient operation of boilers fired by coal, oil or natural gas.

It is not always realized that it requires more than ten tons of air to burn one ton of 13,500-Btu coal. All of this air eventually goes up the exhaust stack, although in a different chemical form.

To estimate the theoretical amount of air required to burn one pound of coal, divide the heating value of the coal by 1350. Thus, for the 13,500-Btu coal previously mentioned, the theoretical air requirement is 13,500 ÷ 1350 = 10 lb. Now furnaces and firing (combustion) can never be quite perfect, so no actual furnace could possibly burn this coal with only ten pounds of air. There must be some excess.

Twenty or thirty per cent excess might be reasonable in a small boiler furnace. With 30 per cent excess air the furnace would use up to 13 lb of air for every pound of coal fired. Since *no* matter is destroyed, and since very little material drops through the grate, nearly 14 lb of hot gas would go up the stack for every pound of coal fired.

To heat one pound of flue gas one degree Fahrenheit, it takes approximately one-quarter Btu. So, consider a case where the boiler-room temperature is 80 F and the stack temperature is 530 F. Then the temperature rise is 530 − 80 = 450 F, and the stack loss in the dry hot gas is 450 × ¼ × 14 = 1575 Btu per pound of coal fired.

If, because of obsolete or shoddily-installed equipment — or excellent equipment poorly operated — the stack temperature was 580 F, and the excess air were 80 per cent, the air supplied per pound of coal would weigh 18 lb and the stack gases would weigh 19 lb per lb of coal fired. The temperature rise would be 580 − 80 = 500 F. Then the loss in the hot dry flue gas would be 19 × ¼ × 500 = 2375 Btu per pound of coal.

The standard method for determining excess air is to analyze the flue gas for CO_2, using an "Orsat" or CO_2 recorder. The sample is taken at the point where the gas leaves the boiler setting. Flue temperature should be registered at the same point. Knowing the CO_2 percentage, we can closely estimate the excess air from one of the charts above.

Then we can use a short cut to approximate the percentage of the coal's heat lost up the stack in the form of hot, dry gases.

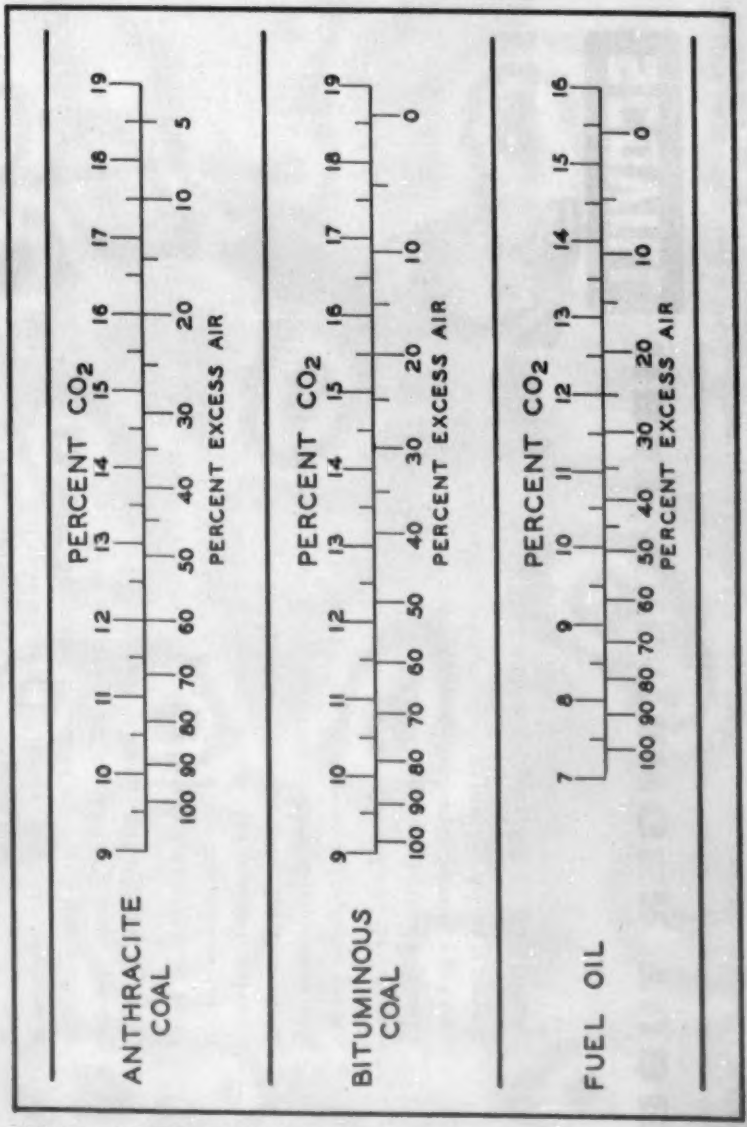
Use the Following Rule:

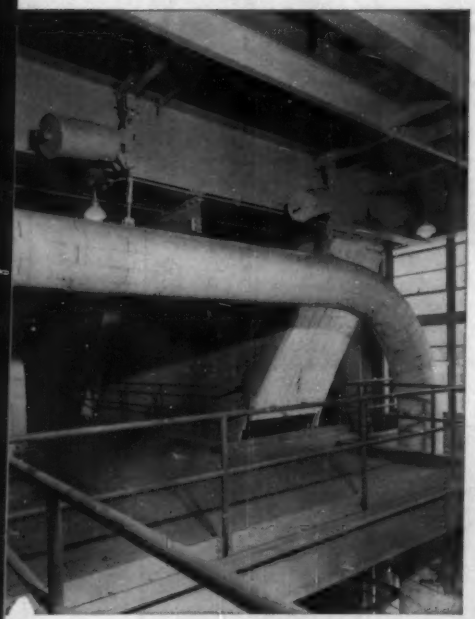
For the theoretical amount of air, allow 1.8 per cent loss for every hundred degrees rise above boiler-room temperature.

For example, if the flue temperature is 520 F when the boiler room or firing aisle is 90 F, the rise will be 520 − 90 = 430 F. With the theoretical air supply the stack loss would be 4.3 × 1.8 = 7.7 per cent.

Increase this figure proportionately to allow for the excess air. For example, if the fuel is anthracite coal and the CO_2 runs 12 per cent, excess air is 60 per cent from accompanying chart. Then actual flue loss is 1.6 × 7.7 = 12.3 per cent.

fold along this line—outside edges toward you





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The photo at the left shows this bend in service supported by dependable Navco Counterpoise Hangers.

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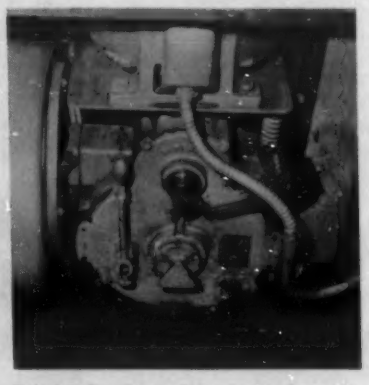
How Much Coal Does A Stoker Stoke?

By C. SHAFF

WE HAVE a small heating boiler operating at 5 psi and producing 150 lb per hr. It is fired by a standard screw-feed underfeed stoker. Our coal is stored outside and in a silo, but no method had been provided to measure coal use. Though we attempted to figure use, the Accounts Dept. would inform us at the end of the year that we were as much as one carload out of agreement with other records.

Since the feed was positive, each revolution of the shaft represented a given amount of coal. We drilled the projecting end of the shaft, therefore, and fitted it with a small crank-pin (see photo), and connected this to a revolution counter.

Periodically, we take readings on the counter and multiply this by the coal-per-revolution factor. This device has been in operation over a year now and we have no further trouble with measuring our coal consumption and supply.



End of shaft projecting from gear box has crank-pin driving counter. Other ways would work also

Don't Guess! Figure the Coal in Conical Piles Against Bulkheads

(See opposite page)

By R. R. TAGGS, E.E.

IN ISSUING reports on the amounts of coal in storage yards, the calculations are sometimes complicated because the storage pile may be against a wall or bulkhead. Where such piles are in the form of a cone — or part cone — the quantity can be determined from the accompanying curve.

The heavy curve indicates the volume of the pile in per cent of the volume of the cone without the bulkhead, for various values of the ratio A/R, where "R" is the radius of the pile at its base, and "A" the distance from the bulkhead to the center-line of the pile.

To use this curve, proceed as in the following example:

Find the tons of coal in a pile 20 ft high having a base diameter of 50 ft, piled against a bulkhead 10 ft from the center of the circular base. The value of A/R is 10/25, or 40 per cent. From the curve we find that for a 40 per cent ratio the pile will have a volume 83.1 per cent of the volume it would normally have if the bulkhead were not there. The volume of the pile *without* the bulkhead is found from the equation:

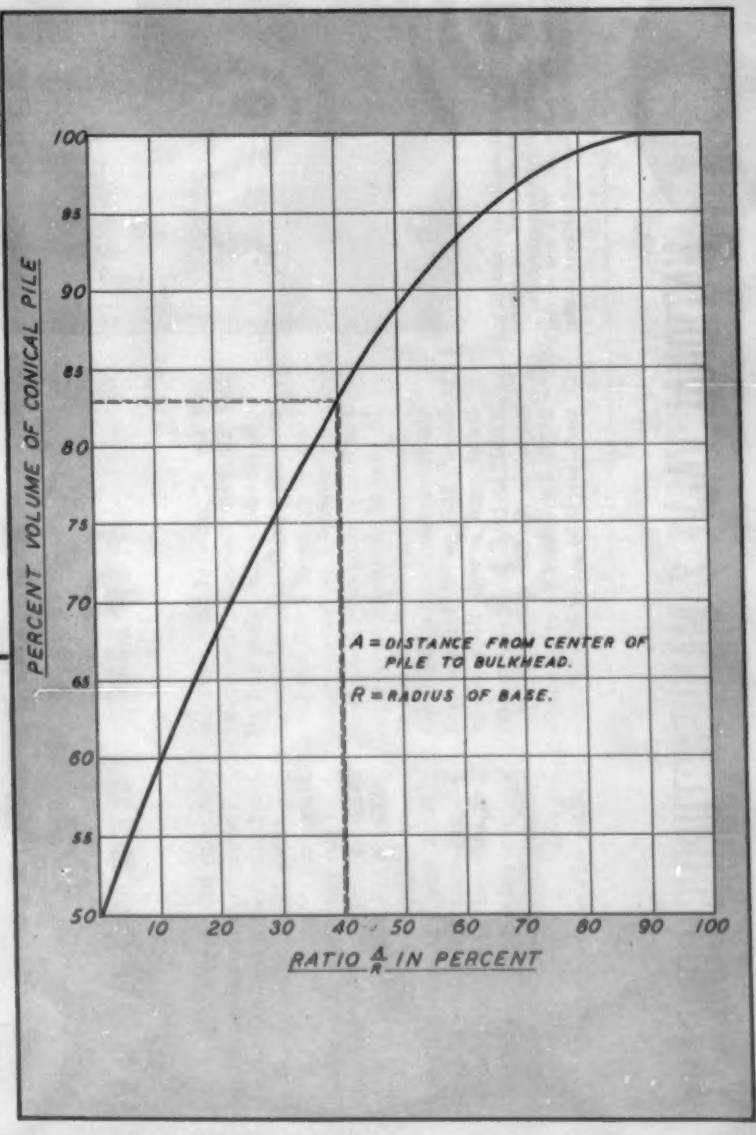
$$V = \pi \frac{r^2 h}{3}$$

Substituting in this equation, we find the volume:

$$V = 3.1416\ (25)^2 \frac{20}{3} = 13{,}100 \text{ cu ft}$$

If multiplied by 83.1 per cent, this gives 10,900 cu ft as the volume of the coal-storage pile. One ton of bituminous coal occupies about 40 cu ft, so that in this particular coal pile there will be 10,900 ÷40, or 273 tons.

fold along this line—outside edges toward you



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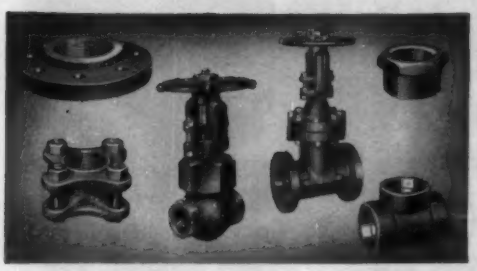

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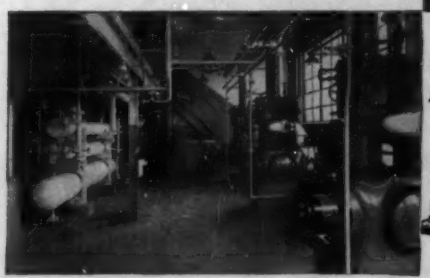

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Power Engineering handbook

Try Magnetic Dial Gage Holders

By F. E. RILEY

ORDINARY dial gages with faces about 2 in. in diameter have many valuable applications for inspection and measuring, but their size often make them very inconvenient for use on lathes and other machine tools. Another inconvenience is the need for extensive auxiliary holding devices and pivoting levers which will change the direction of the gage feeler movement.

Machinists, particularly lathe operators, should use the smallest type of dial gage having a pivoted feeler and which can be adjusted through nearly 180 degrees, for application to the interior of a bore or to the exterior of a sloping surface. Such a dial gage is the Starratt "Last Word," but other forms are available.

For maximum convenience in using such a dial gage for lathe work, a magnetic holder of a very simple type will present it to various work surfaces without the need for hinged or jointed arms and other complications. A typical pivoted feeler dial gage of small size and mounted in a magnetic holder is illustrated in Fig. 1.

In Fig. 1, the magnet is at the right hand end and is adhering to the lathe tool post. The magnet is of cylindrical shape with a slot through one end to form the poles, while the bridge joining them is drilled with a plain hole. An aluminium rod is reduced in diameter at one end and is threaded so as to pass through the hole in the magnet bridge where it is locked in place by means of a non-ferrous nut.

At the other end, the aluminium rod is drilled to take the plain shank protruding from the dial gage body and the two are locked together by means of a headless set screw fitting into a tapped hole in the rod. The method of securing dial gage and rod together will, of course, vary according to the form of dial gage used.

These modern permanent magnets are sufficiently powerful to hold the dial gage firmly on almost any flat surface on the lathe structure. The magnet illustrated is about ¾ in. in diameter so that a small surface will suffice for mounting the gage. This extends the gage's versatility, and also speeds up its application since no clamping is necessary.

The usefulness of the pivoted feeler type of dial gage is shown by its application to the bore of a bushing held in the lathe chuck in Fig. 1. If the feeler is swung around to almost a right angle with the gage body, the face of the bushing can be checked "for true" without moving the magnet from its position on the tool post. As the gage and its magnetic holder are not much larger than the average boring tool, they can be applied to any work which could be reached by a tool.

Another useful application of the magnetically-held dial gage is illustrated in Fig. 2, in which the magnet is adhering to the front faces of the chuck jaws and

fold along this line—outside edges toward you

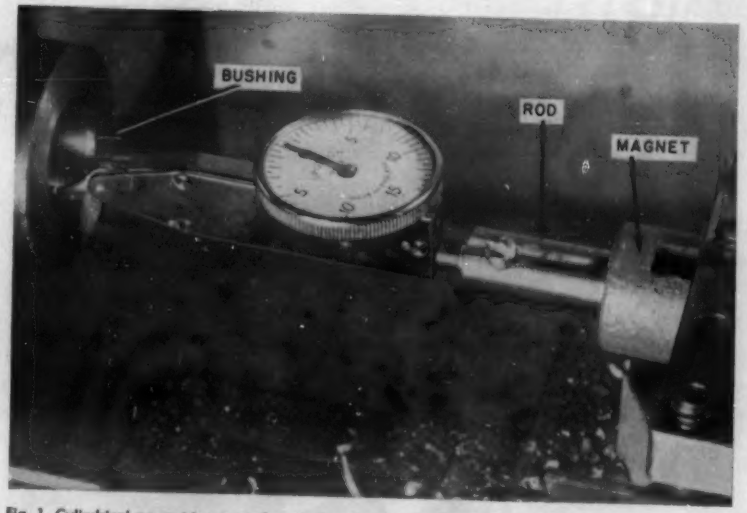

Fig. 1. Cylindrical magnet is mounted on tool post and gage attached to check bushing's bore and face

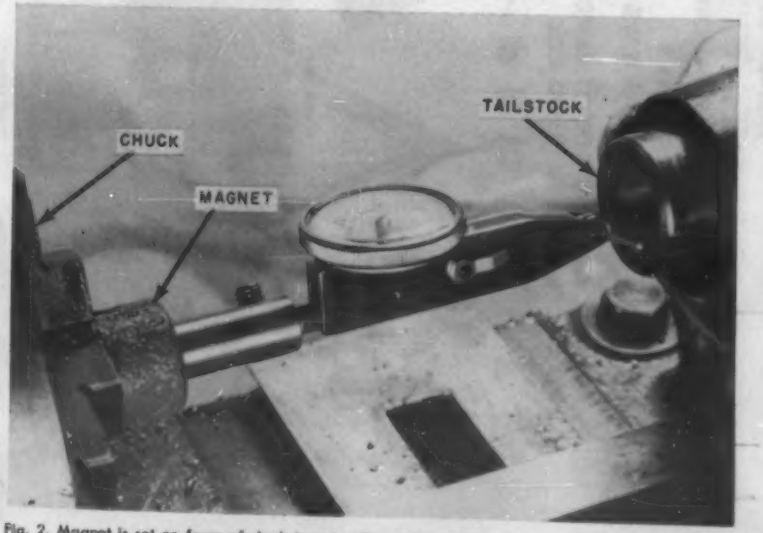

Fig. 2. Magnet is set on faces of chuck jaws to align tailstock barrel with spindle's center of rotation

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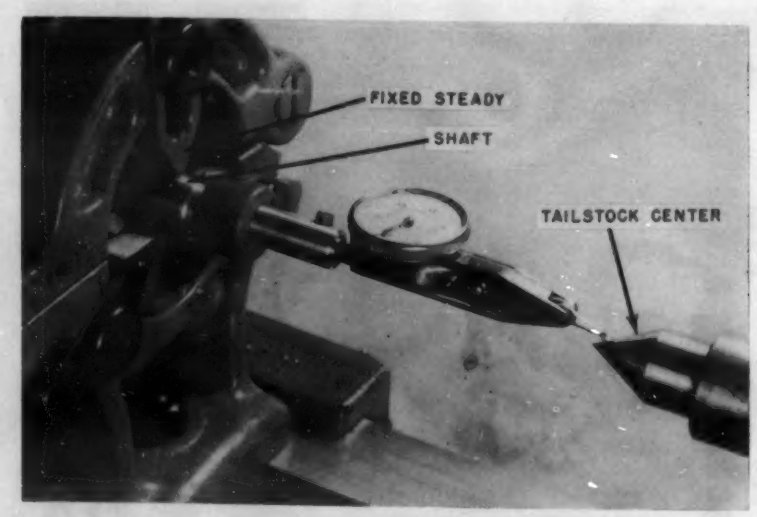

Fig. 3. Magnet set on workpiece held in 3-point steady rest to align axes of workpiece and the tailstock

the feeler is exploring the Morse taper hole in the tailstock barrel. This is the most accurate method of re-aligning the tailstock with the lathe spindle center line. If the chuck is rotated by hand so that the gage feeler makes one circuit of the tailstock bore, any misalignment of the two will be revealed by movement of the dial gage pointer. If the pointer remains immovable during its circuit of the taper hole, alignment between head and tailstock has been achieved. This aligning method is accurate only if the lathe bed is free from twist, but it eliminates entirely the laborious cut-and-try methods often employed.

Lining up of a piece of work supported by the three-point steady rest is always an awkward lathe job. Figure 3 illustrates a way in which the magnetically-mounted dial gage can be used for obtaining perfect alignment between the work and tailstock axes. The gage feeler in Fig. 3 is exploring the conical end of the tailstock center while the magnet is securing the gage to the end face of a $\frac{5}{8}$-in. diameter shaft. Alternatively, the feeler may explore the tapered bore of the tailstock barrel, as illustrated in Fig. 2. Perfect alignment will have been achieved between the work and the tailstock axes when the dial gage pointer remains stationary during one circuit of the center point by the gage feeler.

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Try This Home-made Cutting Oil Gage and Saw Table Adjuster

WHEN cutting oil is carried in a gravity feed tank, there is always a danger of running dry and damaging tools and work. Since these tanks are usually put in elevated "out-of-the-way" places, they are hard to keep a visual check on. The men at Temco (Dallas) solved this problem by installing a pipe elbow near the bottom of their tanks and fitting a plexiglas tube into it to provide a sight level gage. Its cost was $1.50.

This same company has equipped a standard Do-All bandsaw table with a telescoping leg that permits bandsaw operators to change cutting angles precisely and instantly. The leg is made of threaded drill rod fitted inside a sleeve of $1\frac{1}{4}$-in. tubing. A maximum tilt angle of 47 degrees is possible with the leg at its greatest extension.

(Ideas and photographs courtesy of Temco Aircraft)

Fig. 1. Gravity-feed cutting oil tank is fitted here with a clear plexiglas visual oil level indicator

Fig. 2. Bandsaw table is fitted here with extra leg to vary saw's cutting angle; friction lock holds it

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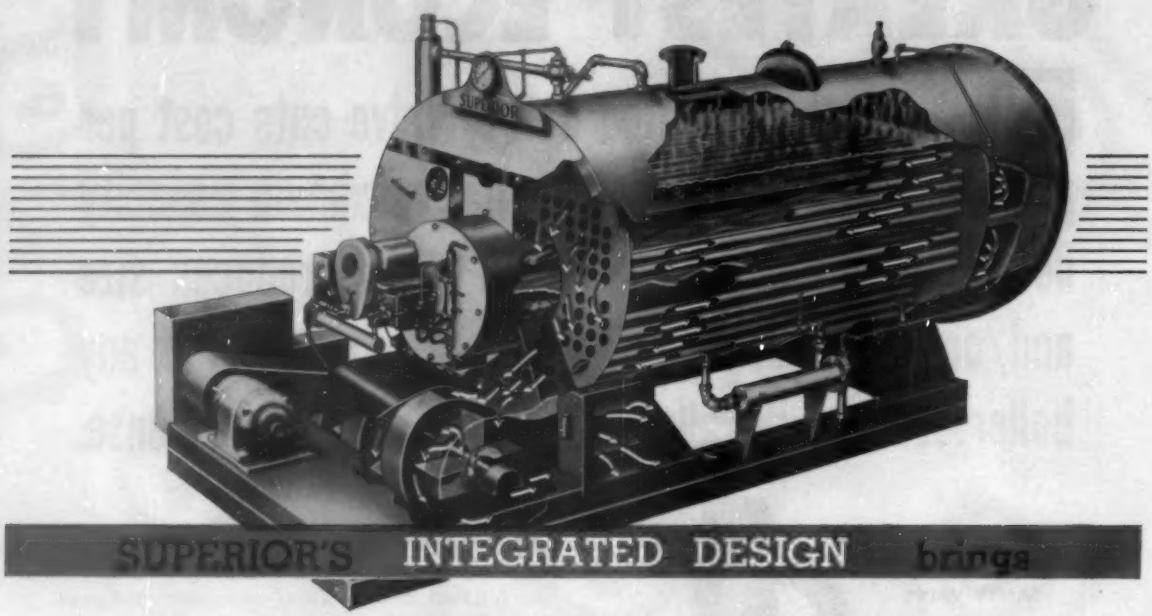

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INSTRUMENTS AND CONTROLS

201 Metering and Control Equipment — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate equipment. Bailey Meter Co.

202 Boiler Feed Control — Bulletin 1003, a 12-pp catalog on boiler feed regulators, is illustrated with large application photos and detailed schematic drawings and charts. Relay and direct operation are covered. Case studies of representative boiler loads are presented to show stability of the Flowmatics in controlling feedwater automatically. Copes-Vulcan Div., Continental Foundry & Machine Co.

203 Electronic Feedwater Control — Three systems for the electronic regulation of boiler feedwater are explained briefly and diagrammed in Bulletin 52-1073-221. They include a single-element, two-element, and three-element system. Applications for each type are given, and descriptions of the flow measuring, receiving, level measuring elements, power unit and valve are included. The Hays Corp.

204 For Feedwater Analysis — Bulletin 148BP contains a technical discussion of manufacturer's analyzers for determination of dissolved oxygen and hydrogen in feedwater. Discusses both O_2 and H units as to function, ranges, accuracy. Cambridge Instrument Co., Inc.

It's easy to get these free catalogs — just circle item numbers of those wanted on the postcard at right.

205 Sampling System — A newly developed system for continuous sampling and oxygen measurement of combustion processes is described in Bulletin 703. Points out advantages of system and diagrams component parts. Selection of sampling tube and gas selector units is discussed. Arnold O. Beckman, Inc.

206 Indicating Flow Meter — Bulletin 18-A, 22-pp, discusses advantages, construction and operation of company's Type H indicating flow meter. Presents technical data on the principles and theory of fluid measurement and discusses orifice type meters and orifice meter principles. Offers examples of flow rate calculations. Schematic drawings and diagrams, tabulated technical data and specifications are included. The Meriam Instrument Co.

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207 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither textbook nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, information on methods of speed control. Allis-Chalmers Mfg. Co.

208 Electric Motors — Twenty types of company's motors are illustrated in 8-pp Bulletin 1878. Illustrated in natural color, the bulletin contains descriptions of Uni-closed, totally-enclosed, explosion-proof, Varidrive, Syncrogear, combination variable speed and internally geared units, right-angle worm gear, and other types. U. S. Electrical Motors Inc.

209 Motor Buying Guide — Bulletin GEC-1026, 28-pp, features company's standard a-c fractional and integral horsepower motors in most general use. Included are general- and definite-purpose fhp motors, and fhp gear motors. A section on selection of integral horsepower motors covers horsepower requirements, enclosures, starting current limitations, speeds, motor types, and selection of fuses and circuit breakers. Descriptions and specifications include single-phase, polyphase, totally enclosed fan cooled, and gear-type integral horsepower motors. Ratings, book prices, dimensions, frame numbers are included. General Electric Co.

210 Insulation Temperature-Resistance — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, and a practical method of obtaining insulation temperature. James G. Biddle Co.

211 The Answers on Wiring — "20 Questions and 20 Answers on Safety m.i. Wiring" describes and illustrates characteristics and advantages of this new wiring system. A complete table of types, sizes, weights and lengths, as well as a partial list of users included. General Cable Corp.

212 Batteries for Control, Switchgear — This company's PlastiCal (lead calcium) and PlastiCell (high-tensile alloy grid) batteries for control, switchgear, and auxiliary power are described as to design, application and performance in Bulletins CP-536 and CP-537. Specifications and dimensions included. C & D Batteries, Inc.

WATER CONDITIONING

213 Handbook on Demineralizing — Comprehensive 40-pp Bulletin 5800-B compares various methods of water treatment, indicating the comparison between demineralizers and evaporators. It discusses the characteristics of the various types of available cation and anion exchange materials and offers data on operating cost of demineralizing. It tells when to use 2-bed, 3-bed, 4-bed, mixed or mono-bed demineralizers. It also indicates when decarbonators or vacuum deaerators should be installed. Cochrane Corp.

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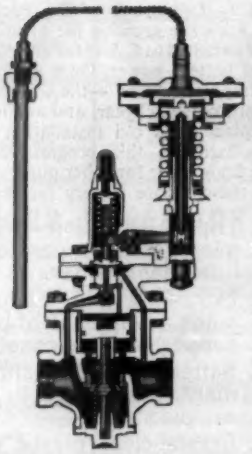

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214 Modern pH and Chlorine Control — This 100-pp booklet gives details in color comparators and equipment in water testing and control of boiler and industrial process water, also technical information on meaning of pH control, electrometric and colorimetric methods of determining pH and impurities in water; applications of water control in air conditioning; feedwater. W. A. Taylor & Co.

215 What's What on Ion Exchangers — Here are three booklets on ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nalcolite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques discussed. Bulletin 57, 20 pp, is on Nalcite SAR; Bulletin 58, 28 pp, Nalcite HCR; Bulletin 59, Super Nalcolite. National Aluminate Corp.

216 Microbiological Control — Technical Article 3C, 12 pp, is an illustrated discussion of microbiological control of and through industrial waters. A section on industrial water chlorination covers cooling waters and process waters. Other sections deal with chlorine metering in chemical processes, and the sanitary aspects of industrial water treatment. Wallace & Tiernan Co., Inc.

217 Chemical Treating of Feedwater — Application Engineering Data Sheet D-54-3 discusses use of Hydrazine in treating feedwater for high pressure boilers. Tells how precise addition of this chemical to boiler feedwater maintains residual oxygen content at zero and also prevents ammonia accumulation in the system. Milton Roy Co.

218 Feedwater Treating — Bulletin 1855, 30 pp, features manufacturer's hot process Accelerator for treatment of boiler feedwater, illustrating and explaining its operation and advantages, also optional equipment. Contains excellent discussion of necessity for treatment of makeup water, selection of proper equipment. Also covers the limitations of hot process softening. Infilco Inc.

219 Water Conditioning Data Book — An excellent reference volume, Data Book 2478A contains 108 pp and presents a compilation of 78 chapters and tables. Subjects covered include hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships; specific gravities; chemical reactions. Available to qualified power engineers, please state your job title when requesting this. The Permutit Co.

220 Demineralizers — Valuable information on demineralization is offered power engineers in comprehensive 24-pp Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special uses are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems for chemical plants and power plants. Graver Water Conditioning Co.

221 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered

by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

VALVES, TRAPS, PIPING AND ACCESSORIES

222 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principles of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

223 Lubricated Plug Valves — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

224 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Speciality Co.

225 Blow-Off Valves — Bulletin B-426, 20 pp, on blow-off valves for boiler pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data. Yarnall-Waring Co.

226 For Precise Control — Fifty-pp Catalog 17 covers manufacturer's line of disc valves and accessories, providing full selection and ordering data, materials of construction, sizes. Describes manual and automatic controls for these valves which, it is noted, are available in any metal which can be cast or welded. Minimum pressure drop, quick closure, simplicity and other advantages are discussed. R. S. Valve Div., S. Morgan Smith Co.

227 Regulating Valves — Bulletin 5305 describes double seated diaphragm regulating valves for use with control instruments, outlining special features of the valves, particularly the "flow line" contoured-body engineered for high capacity at low pressure drop. Leslie Co.

228 Controls Sizing Manual — This 24-pp book presents a tested method for sizing control valves, the tools for which are company's size-o-graphs and Cv ratings. The size-o-graphs — for determining what valve must do — give flow equations for gas, steam and liquid services. The Cv ratings — for determining what valve will do — symbolize flow coefficients and serve as a yardstick for performance of diaphragm control valves, regulators, drainers and lever valves. Book also provides conversion equations, pressure-temperature ratings. Available to qualified power engineers, please state your job title. Black, Sivalls & Bryson, Inc.

229 Choosing the Right Valve — Presenting valve selection as a matter of matching the valve's service characteristics with service requirements of the job, this practical 20-pp booklet explains and illustrates basic design features of gate, globe and check valves. It tells, in non-technical language, how each of these valve types works, and where it is suited

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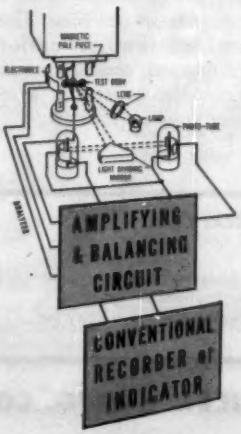

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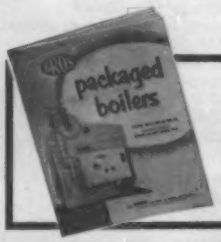

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for use. Disc, stem connection, bonnet and bonnet-joint characteristics are also discussed and the importance of stem operation is treated. Crane Co.

230 Valve Chart — Form 194, 24 pp, is a valve comparison chart, listing valve figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous and non-ferrous materials, describes different valve lines. The Ohio Injector Co.

231 Steel Gate Valves — Five types of Hancock general purpose steel gate valves for process and power piping systems are described in illustrated Bulletin 202 B, 12 pp. Material specifications, dimensions given, also service pressure ratings. Manning, Maxwell & Moore, Inc.

232 General Service Valves — Bulletin E-160, 16 pp, describes and illustrates design and construction of company's quick-operating valves, explaining their application to blow-off service and on chemical process, soot blowers, water column blow-down, and other types of pipe line. Everlasting Valve Co.

233 Industrial Valves — Condensed Catalog 105, 28-pp, contains data on valves for a wide variety of applications. Includes dimensions and illustrations describing non-return (stop-check) valves, globe and angle stop valves, pressure seal design, angle univalves and small size globe valves designed for chain or extension operation in vertical lines. Also included is company's Mudwonder valve for abrasive fluids. Edward Valves, Inc.

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234 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

235 Industrial Steam Traps — Twelve-pp Bulletin 853 describes steam traps with bellows of bronze, Monel or stainless steel, and bodies in bronze, semi-steel and cast steel construction in sizes ¼ to 2 in., for pressures from vacuum to 300 lb. Included besides capacity tables and dimensions are piping diagrams, typical applications. W. H. Nicholson & Co.

236 Steam Trap Solutions — Bulletin F. 151, 36 pp, is a newly revised edition of this company's well known booklet, "Solving Steam Trap Problems." Organized for easy reference, this illustrated booklet provides specifications and capacities of steam and float traps, air release valves, pipe line strainers. Tells how to calculate condensation loads and select traps for unit heaters, jacketed kettles, submerged surfaces. Gives pointers on installing traps. The V. D. Anderson Co.

237 Unions and Fittings — Twelve-pp Catalog 50 covers manufacturer's line of unions of all types, elbows, tees and fittings. It describes and illustrates special features. Dart Union Co.

238 Welded Fittings — Catalog 3 is a 36-pp ordering and engineering reference book on company's Weldolets for piping services. Gives data on butt-welding and socket welding Weldolets as well as on Thredolets for making threaded outlets. Typical installations are pictured; sizes, weights and prices provided. Also included are installation instructions and a technical section. Bonney Forge & Tool Works.

239 Improved Pipe Hanger — Twelve-pp Bulletin 153 describes company's Counterpoise pipe hanger for high temperature piping systems in steam generating stations, refineries and chemical plants. Tells how it offers efficient load supporting effort of constant value throughout entire range of travel as pipe expands or contracts because of temperature changes. National Valve & Mfg. Co.

INSULATION

241 Pipe Insulation — Mono-Kover, a lightweight one-piece pipe insulation, is described in this bulletin. Photos show how easily it is applied, and text covers its thermal resistance, permanence, resiliency, non-corrosive properties and lower applied cost. Also included are a thermal efficiency chart, insulation thickness selection table, and information on sizes and thicknesses available. Baldwin-Hill Co.

242 Insulating Material — Ultrafine, a thermal and acoustical insulation made of blown glass fibers, is presented in this bulletin. Shows it in use; gives data on properties, thermal conductivity. Gustin-Bacon Mfg. Co.

COAL, ASH HANDLING

243 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; pictures several models. Tractor Div., Allis-Chalmers Mfg. Co.

244 Burning Bituminous Coal — This 24-pp illustrated booklet is a compilation of numerous actual case histories of industrial plants and institutions which burn bituminous coal "the modern way." Stressing operating economy achieved, these case histories show problems overcome, equipment used, and savings realized. Bituminous Coal Institute.

245 Spreader Stoker — Sixteen-pp Bulletin 800 describes manufacturer's Type C-C RotoStoker, a relatively small spreader stoker offering continuous cleaning and ash discharge advantages of larger units, without need of a basement for ash-removal. Explains this and other operational advantages of the stoker, which is adapted to modern steam boilers with output capacities of about 5000 to 75,000 lb of steam per hour. Detroit Stoker Co.

246 Spreader Stoker Data — This is a file of three illustrated bulletins on spreader stokers. The first discusses seven reasons for selecting these stokers and describes their design, construction and

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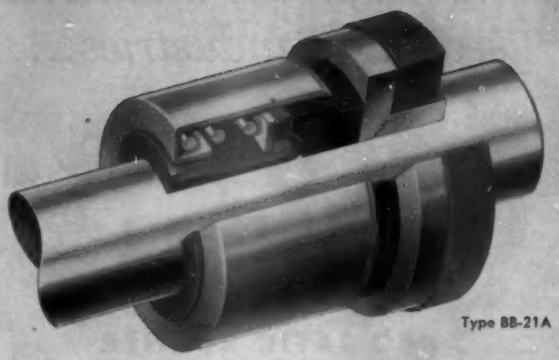

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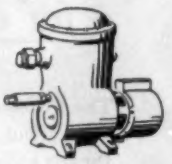

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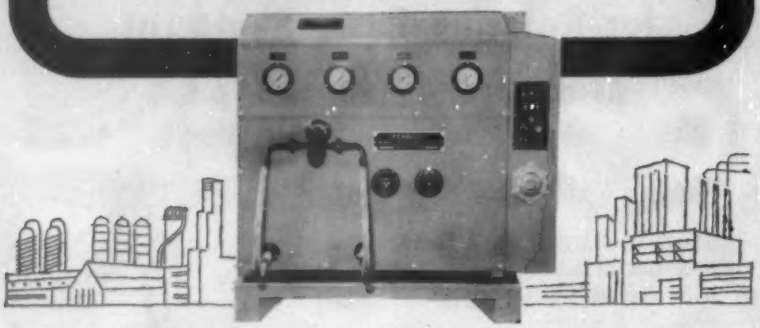

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operation; the second, dumping grates, the third, installations. Riley Stoker Corp.

247 **Fly Ash Collection** — The successful and economical separation of fly ash from boiler flue gases is discussed in 28-pp Catalog G405. Explains need for collection equipment and gives physical characteristics of fly ash. Describes company's Multiclone equipment as to principle of operation, performance and advantages. Western Precipitation Corp.

248 **Why Liquid Diffusion** — What liquid diffusion can do for power plants is explained in Form B, which tells how liquid diffusion compounds work and gives four practical applications. These include dust control in coal handling, fly-ash control, coal storage pile treatment and boiler cleaning. Johnson-March Corp.

REFRACTORIES

249 **Refractory Concrete** — Basic information on recommended practice for mixing and placing refractory concrete, used in the metal, power, ceramic, and petroleum refining industry as a material to withstand service temp to 2600 F or more, is presented in this 16-pp manual. Sections are devoted to special properties of refractory concrete, aggregates, refractory insulating concrete, and structural design. Charts and tables afford easy reference. Universal Atlas Cement Co.

250 **Refractories for Heat, Power** — Compiled to help power engineers solve refractory problems and get greater operating efficiency from their boilers, this booklet provides 32 pp of practical information on company's Crystolon refractories. Properties and characteristics of these silicon carbide products are given and separate chapters cover those for air-cooled, solid wall and water tube protection, and for repairs. Norton Co.

PUMPS, PUMPING

251 **Boiler Feed Pump** — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up is the subject of 12-pp Bulletin 1525. De Laval Steam Turbine Co.

252 **Gear Pumps** — Besides presenting all of company's standard gear pumps, 24-pp Bulletin 17-A describes briefly some special types engineered for unusual requirements. Discusses design, construction and operation of the pumps; tells how they're used in the power and industrial fields. Drawings, action photos, capacity and pressure tables and performance data supplement the text. Booklet covers pumps ranging from 1 gph to 1000 gpm capacities. Schutte and Koerting Co.

253 **For Abusive Pumping Jobs** — Catalog 4906, 36 pp, covers centrifugal pumps for wide, industrial use and especially adapted to handling ashes, abrasive mixtures, slurries, hot and corrosive liquids. It describes several basic types: a horizontal shaft, single-stage side suction pump; a horizontal shaft, single-stage, rear-entrance automatic priming pump; vertical shaft pumps with standard, overhead and quill bearings for wet pit applications. Nagle Pumps.

254 **Sump Pump Selector** — Bulletin 54-3-1420, 20 pp, provides a selection table allowing a power engineer to choose any of the 4000 models of the BJ Sump-

master pumps, which range from 10 to 2600 GPM with heads from 20 to 300 ft. Includes complete dimensions and outline drawings. Byron Jackson Co.

255 On Vertical Pumps — This 16-pp bulletin describes and illustrates application of vertical industrial service pumps for liquid transfer from short settings in both industrial and process services. Points out advantages and describes three basic designs. Stresses versatility of the pumps due to design flexibility. Also gives general recommendations for obtaining optimum performance, and includes photos of typical installations. Peerless Pump Div., Food Machinery and Chemical Corp.

PACKINGS, GASKETS, SEALS

256 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for many applications. Packing Div., Raybestos-Manhattan, Inc.

257 O-Rings for Sealing, Gasketing — Catalog AD-148, 20 pp, describes company's O-rings for sealing and static gasketing. Gives design information, recommended pressures, and available materials for both dynamic and static applications. The Garlock Packing Co.

BOILERS, GENERATORS

258 Shop-Assembled Boiler — Sixteen-pp Bulletin G-76 completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000 lb of steam per hr, pressure to 250 psi. The Babcock & Wilcox Co.

259 Packaged Boilers — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 30,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

260 Standard Boilers — Eight-pp Bulletin WT-8 describes company's "S" series of boilers with capacities ranging from 10,800 to 50,000 lb. Lists data and specifications on each of the models and sizes, and discusses general design features and special "S" type construction features. Wm. Bros Boiler & Mfg. Co.

261 Improved Steam Generator — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimensions for the units which range from 20 to 6000 hp. Preferred Utilities Mfg. Corp.

262 Steam Generators — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-tube boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cutaway illustration shows design details, and gas travel. Erie City Iron Works.

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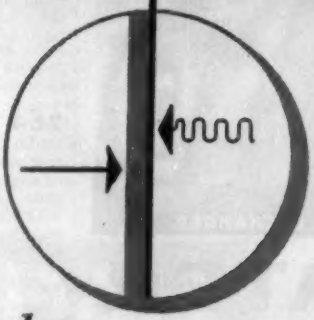

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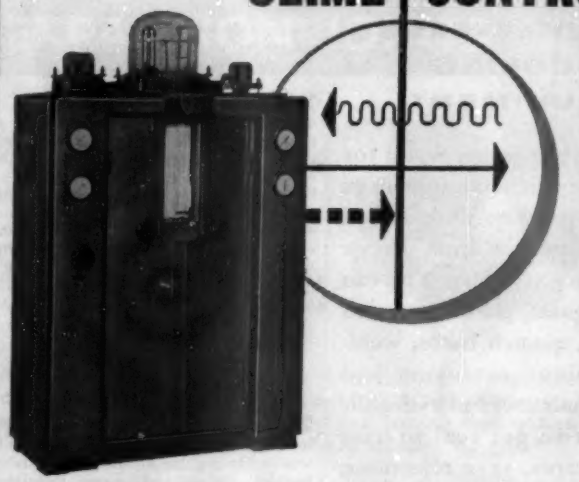

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263 Steam Generator — This manufacturer's new Type *D* steam generator, a packaged unit for pressure firing with gas, oils or combination of fuels, is described in an 8-pp catalog. Gives complete data and dimensions on this water tube generator which is available in 17 sizes with capacities from 8000 to 40,000 lb of steam per hour. Fully illustrated, booklet explains economical steam production, low installation cost, other advantages. Superior Combustion Industries Inc.

BURNERS

264 Oil and Gas Burners — Bulletin OB-53, 28 pp, gives principles of selection and application of oil or gas burners, or a combination of both for standard and wide capacity range operation, together with air registers and fuel oil heating and pumping sets. Conversion table shows approximate relationships between quantity of oil burned, boiler capacity and air required for combustion. Specifications included. The Engineer Co.

265 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces, where steam or compressed air is available for atomizing the oil. Includes information on furnace design and construction. National Airoil Burner Co., Inc.

266 Automatic Burner — Bulletin 420 contains approximately 30 pp of engineering data on a new burner unit for gas, oil or combination firing and sized for capacities to 42,000 lb of steam per hour. Separate sections of this looseleaf manual are devoted to photos and discussion of special features of the burner, general specifications, parts list, wiring and piping diagrams, explanation of operating sequence, and performance data. Available to qualified power engineers, please state your job title when requesting this bulletin. Peabody Engineering Corp.

TUBING AND ACCESSORIES

267 Condenser Tubes — Excellent information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Gives details on proper installation. Scovill Mfg. Co.

268 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads. Roto Div., Elliott Co.

269 Nickel Pipe and Tubes — Bulletin T-17 is a 28-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

270 Tube Cleaners — Catalog 76-A provides 48 pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes,

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and motors, giving sizes, application information. Air valves, hose, lubricators are described. Thomas C. Wilson, Inc.

271 Life Extension for Condenser Tubes — This 32-pp extensively illustrated booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

OTHER EQUIPMENT

273 Steam Accumulator — How the steam supply and demand can be balanced by means of company's steam accumulator is told in Bulletin RA-52-8. Stresses reduced boiler capacity required and increased boiler efficiency afforded by use of the accumulator, other advantages. Discusses operating principle, tells how to figure capacity. Foster Wheeler Corp.

274 Turbine Speed Control — Thirty-pp wire-wound Bulletin H-21 is titled, "Fundamentals of Turbine Speed Control." It is an elaborately illustrated, educational booklet intended to clarify the operation of common types of automatic speed control for steam turbines. An introductory section covers general fundamentals of automatic control systems, and includes a key to control terminology. Simplified diagrams show operating principles of actual control systems. Elliott Co.

275 Preheating Combustion Air — This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels, other advantages afforded. Booklet contrasts regenerative with recuperative preheaters; explains operating principle and structural details of the Ljungstrom air preheater. Applications for other than power boilers are also covered. Air Preheater Corp.

276 Steam Condensers — Some recent additions to this company's power plant condenser installations are pictured and described briefly in this 24-pp booklet. Also included are an engineering section on condenser design factors, and sections devoted to air removal equipment, to steam condenser specialties, and to maintenance services available. Condenser Service & Engineering Co., Inc.

277 Refrigerator Condensers — Bulletin RC-2, 38 pp, utilizes drawings, tables and engineering data to show how to select proper type from company's line of ammonia and Freon condensers for refrigeration services. Illustrates horizontal multipass shell and tube types; vertical singlepass shell and tube types. Gives pipe sizes for ammonia and Freon lines; stands for condensers. Henry Vogt Machine Co.

278 Fluid Drive — Of value to power engineers interested in obtaining adjustable speed operation in a range from 100 to 2500 hp is 24-pp Bulletin 9319, illustrated in color. Covers company's Type VS, Class 4 Gyrol fluid drive, explaining its principle of operation and illustrating its use. American Blower Corp.

279 Corrosion, Abrasion Control — Modern practices and products for the positive protection of metal equipment from the effects of corrosion and abrasion are described in this 16-pp bulletin. Covers factory and field application of rubber or synthetic linings to metal parts or products, and maintenance coatings available for application by plant personnel. Also gives detailed information on accelerators, thinners, primers. Goodall Rubber Co.

280 Single-Stage Steam Turbines — Bulletin 1954-C, 8-pp, describes single-stage steam turbines with steel casing construction. A cutaway view of a typical unit shows standard features. Information on the availability of various frames for single-stage applications, details on variable speed governors are included. Photos and descriptions of special features, along with a longitudinal diagram, present a picture of the machine's operation. A chart lists dimensions. Worthington Corp.

281 Technical Refrigeration — Twelve-pp Bulletin 754 covers a complete line of environmental testing and processing equipment. Provides illustrations and specifications on recently redesigned altitude, humidity, low temperature and prefabricated test chambers as well as specialized testing equipment. Includes helpful engineering data. Bowser, Inc.

282 Diatomite Filters — Bulletin 5502 explains how the diatomite filter works, illustrating the operation with a series of sectional drawings. Precoating, filtering and cleaning are shown in three steps. Points out applications, describes construction features. General Filter Co.

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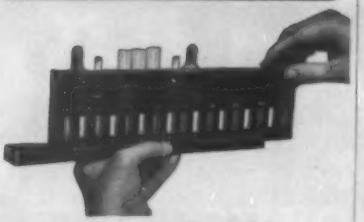

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OBITUARIES

William J. Kelly

WILLIAM JARMLEH KELLY died at age 56 in Chicago, following an extended illness. He was president of the Machinery and Allied Products Institute and Chairman of the Council for Technological Advancement, national spokesman for the capital goods industries, and senior partner of William Kelly & Company of Chicago.

Mr. Kelly assumed the Presidency of the Machinery Institute in 1937 at age of 38 at the peak of a brilliant career in banking and capital goods manufacture, and is generally credited with the leadership of this national organization to a prominent position of prestige and accomplishment.

He was director of Commonwealth Edison Co. and of several capital goods manufacturing companies. He was founder and honorary chairman of The Economic Club of Chicago, served the Chicago Association of Commerce as General Secretary, as Vice President, and as Director. He was special consultant to the Chairman of the War Production Board, trustee of the Illinois Institute of Technology, trustee and executive committee member of Armour Research Foundation, member of the Citizens Board of the University of Chicago and of Northwestern University Associates. He was a director of the National Foundation for Infantile Paralysis, The Chicago Maternity Center, North Side Boys Club, trustee of the Chicago Latin School, governing member of the Art Institute of Chicago. He served twice as Assistant Treasurer of the Republican National Committee, and frequently as Fund Director for Community and War Funds and Navy Relief campaigns.

J. L. Hecht

JULIUS LAWRENCE HECHT, 74, 2044 Elmwood Ave., Wilmette, Ill., retired vice president in charge of operations, Public Service Co. of Northern Illinois, died June 9 in Wesley Memorial Hospital.

Mr. Hecht, a 1904 graduate of Massachusetts Institute of Technology, was a pioneer in the electric utility business, starting some 50 years ago with the North Shore Electric Co., which later was merged into Public Service Co. of Northern Illinois. An engineering executive in public utility operations, he was outstanding in the design and development of modern electric generating stations. He was elected vice president of Public Service Co., in 1923 and served continuously in that capacity until his recent retirement.

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FIG. 17-28 Cylinder

FIG. 215 Flanged

FIG. E-57 Double Window

FIG. 212 Visibility Welding Neck or Screw

FIG. E-811 Flapper

FIG. E-1810 Rotating Wheel Type

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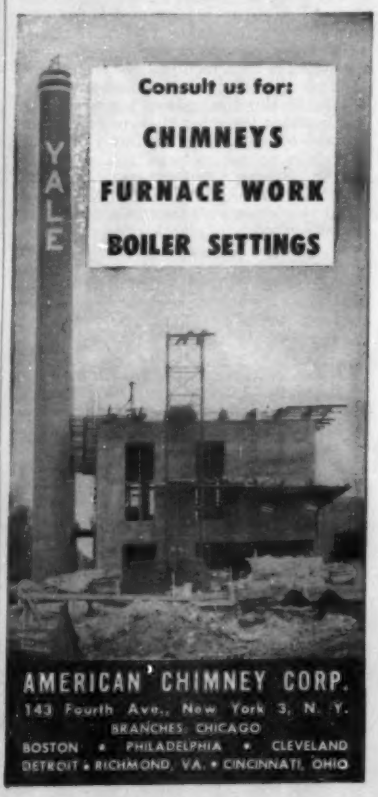

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He was an active member of Western Society of Engineers, serving as its president in 1922 and given honorary membership in 1947; a member of the Engineers Club, and was made an honorary member in 1951.

NEW ENGINEERING BOOKS

The Restless Universe, by Max Born. 2nd edition; 315 pages, 6¼ x 9½ in.; cloth binding. Published by Dover Publications, Inc., 1780 Broadway, New York, N. Y. Price $3.95.

In this remarkably readable account of modern physics, one of the world's great scientists takes you step by step from an understanding of the infinitely small atom to a comprehension of the infinitely large universe.

Out of print for several years, The Restless Universe has been revised and enlarged. Included in this new edition is a discussion of the alliance between politics and science that is well stated and searching and focuses upon one of the most vital contemporary issues.

In addition to the more than 100 drawings and photographs, this book contains seven unique animated diagrams. Each of these consists of about 125 separate illustrations in the margins which give a motion picture effect when the leaves of the book are flipped.

In this book, Max Born explains the latest theories of wave mechanics, the mysteries of perpetual change in a world where nothing is fixed. He explores with you the puzzles which relativity, electricity and the newer mathematics present. Max Born is well known as a teacher and as an important leader in what Louis deBroglie has called "the new physics." Born helped formulate quantum mechanics. He is the author of numerous books and articles, and has one of the most comfortable and lucid styles in scientific literature.

★ ★ ★

Engineering Analysis — An Introduction to Professional Method, by D. W. Ver Planck and B. R. Teare, Jr. Size 9 by 5¾; 344 pages including index. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.00.

Although written for the undergraduate engineering student, this new book by two members of the Carnegie Institute of Technology faculty can be of great value to many practicing engineers by helping them to reappraise their established approaches to engineering problems. Essentially, the book stresses the basic philosophy of the professional engineering method as distinguished from the day-to-day practice of applying learned techniques and mathematical manipulation to familiar situations. The engi-

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★ ★ ★

Lubrication of Industrial and Marine Machinery, by Forbes, Pope & Everitt. Size 9¼ by 6 in., 351 pages; cloth binding. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.50.

This is the second edition of an excellent and popular book. Its purpose is to provide a textbook to explain the fundamental characteristics of conventional lubricants. It is written simply and clearly, and covers the whole field of lubrication. In any book covering such a wide field, each section can be covered only very briefly but within this limitation the authors have dealt with each item very thoroughly indeed, and as they point out in their preface, it is their hope that the book will stimulate the student to further study in many of the phases that have been necessarily briefly covered.

The book is arranged to provide a logical sequence of study. The first 14 chapters deal with the chemistry, refining, compounding, and specifications for lubricants. Chapters 15 to 30 explain the lubrication requirements for the most common types of machinery which include steam engines and turbines, hydraulic turbines, hydraulic systems and fluid couplings, air compressors and vacuum pumps, pneumatic tools, refrigerating machines, reduction gears, internal-combustion engines, and gasoline engines.

The concluding chapters give practical examples of how the knowledge gained may be applied to the lubrication of equipment.

We recommend this book to anyone wanting to obtain a clear outline of the whole field of lubrication.

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Tested Approaches to Capital Equipment Replacement, Special Report No. 1. Size 6 by 9 in.: 94 pages including contents. Published by the American Management Association, 330 West 42nd St., New York 18, N. Y. Price $3.25 (non-members) or $2.25 (members).

Replacing capital equipment no longer depends exclusively on the maximum life of the equipment, but has become a complex problem involving obsolescence, tax structure, labor costs, material wastes — and so on into the night. On May 3–4, 1954, some of the best financial men in business today gathered together at the Commodore Hotel in New York City to discuss this problem and to swap notes on how they were handling it in their own companies. This small booklet is an accurate report of what was said at that meeting.

Subjects discussed are indicated by the following titles:

"Operating and Managerial Factors"
"Economic and Financial Factors"
"An Over-All System of Capital Controls"
"The Investor's Method of Computing Rate of Return as Applied to Replacement Valuation"
"A Scientific Formula for Solving Replacement Problems"
"The Competitive-Demand System of Capital Budget Preparation"
"Lease or Purchase? Alternative Methods for Industrial Financing"
"A Comprehensive System of Performance Reports"

While the usual amount of wind was created by the original presentations, this has been well-edited from the booklet and the remaining text is concise and to the point. If you have equipment replacement problems (and if you are in business you have them) this booklet is valuable to you.

It's going on all the time!

Foreign solids accumulate in boilers continuously. If you would hold the concentration within suitable limits it follows that removal must also be continuous. You cannot expect to maintain efficient trouble-free steaming by blowing now and then; but too often you can expect to upset the load balance and waste a lot of heat units as well as money down the drain. Why not learn about the modern way to blow boilers, save trouble, save money and avoid stress upon equipment; write for catalog on "Correct Blow-Off" to *The Madden Corp., 1543 W. Morse Ave., Chicago 26, Illinois.*

Practical Piping Flexibility Design & Flow, by W. A. Thomas. First Edition, 190 pages, 8½ by 5½ ins.; loose leaf ring binder. Lithoprinted by Pitt Photo-Litho Co., 2742 Philadelphia Ave., Pittsburgh 16, Penna. Price $25.00.

This book is for engineers responsible for analyzing thermal stress and reactions in piping systems. It eliminates long and complex calculations by using charts and graphs for quick solutions of intricate problems.

Included in the book is a preliminary criterion chart which enables the reader to determine if the system is possible and worthy of further analysis. If it is, the system to be checked is then selected from a table of key shapes and then two master charts are used to find maximum stress and the reactions.

A section on flow of fluids in pipes and pumping gives formulas, charts and tables for the flow of water, steam up to critical pressure, and viscous liquids. Steam pressure drops are found in one chart and the velocity and most economical size are given in another.

A section on design data includes a new shortcut treatment of thermal stress in plates, bars, and cylinders; a method of rapidly approximating the maximum stress in transversely loaded flat plates of regular and irregular boundaries; an article on design of drum-type expansion joints; formulas for determining the stresses in vessels due to supports; formulas for proportioning pipe flanges, and a curve for determining the deflection of centrally-loaded fixed edge circular flat plate when the deflection is larger than valid by bending formulas. Many other shortcuts are given, such as a simple planimeter with formula for obtaining accuracy to within 2 per cent.

The subjects in this book are treated in an original manner, permitting the reader to apply time-saving methods to commercial problems.

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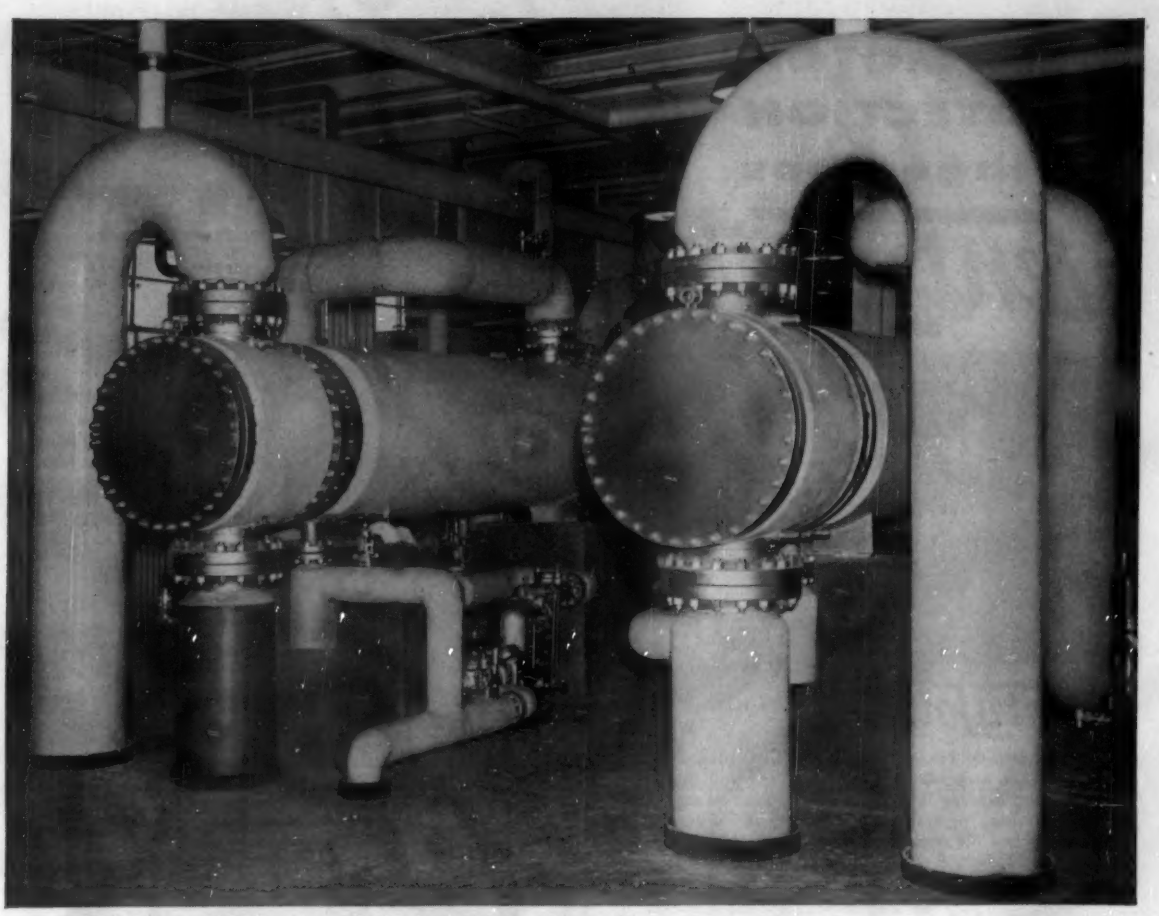

Unibestos provides low cost, effective insulation for pipes and exchangers used in the Great Northern chemi-groundwood plant.

Unibestos reduces application costs on bends and joints

Here is a stronger, longer lasting insulation that can be cut and mitered for quick, easy insulation of bends, expansion joints, tees, ells and other fittings. A minimum of cementing is required at the joints because UNIBESTOS' long, interlacing fibers form positive heat seals.

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Amosite, the well known South African asbestos with the long resilient fibers, gives Unibestos its superior insulating qualities. Heat loss at the joints is minimized due to interlacing of fibers.

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In its multimillion dollar expansion program, the Great Northern Paper Company utilized Unibestos to provide efficient insulation for many processes.

For complete information, write for descriptive Bulletin 109C

UNARCO

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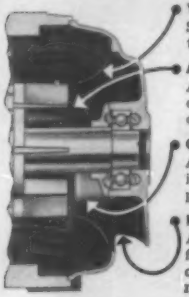
NEW MOTOR PROTECTION with ingenious Ventrifoil

Ventrifoil

WATER FOIL

AT EACH END OF THE MOTOR

DIRECTS AIR AND DEFLECTS WATER—Ventrifoil directs air around bearing housings and into fans on the rotor. By forming a "vestibule" between the bracket openings and the fan inlet, water is deflected and separated from the air stream.



VENTRIFOIL
Securely fastened to inside of bracket to direct air and deflect water.

AIR PASSAGE
Air is brought in at bottom but enters motor only through top half of deflector.

CURVED WATER FOIL
A curved projection of the Ventrifoil is concentric with the shaft and prevents entrance of water.

PROTECTED VESTIBULE
After entering bracket openings, air flows upward through a protected chamber within bracket before reaching motor windings.

All New UNICLOSED TYPE H
U. S. MOTORS

In addition to Ventrifoil, U.S. Motors' new NEMA dimensioned Type H motor embodies a host of revolutionary exclusive features, such as improved asbestos-protected windings, Lubriflush transverse lubrication, normalized castings, solid cast rotor; all directed to the objectives of longer motor life and more efficient power.

Mail Coupon for informative full-color Bulletin ➡

U. S. ELECTRICAL MOTORS Inc.
P. O. Box 2058, Los Angeles 54, Calif.
or Milford, Conn. PE-7
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Babbitt —Adjustable— SPROCKET RIM *with Chain Guide*

ANY VALVE is readily accessible *from the floor* with low-cost Babbitt Sprocket Rim. Now re-designed for—

- **Greater strength**
- **Easier, quicker, more solid assembly**

Simplifies pipe layouts, prevents accidents, fits all valve wheels. Your supplier carries complete stocks. Call him — or write for folder and prices.

Babbitt STEAM SPECIALTY CO.

4 BABBITT SQUARE, NEW BEDFORD, MASSACHUSETTS, U. S. A.

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PREVENT BOILER CORROSION

Oxygen dissolved in boiler feed water which is a very active source of destructive boiler corrosion may be continuously detected and recorded by the Cambridge Gas Analyzer. The oxygen dissolved in the feed water is determined directly, and continuously recorded upon the Cambridge Dissolved Oxygen Recorder. The oxygen set free by dissociation in the boiler is determined by measuring the free hydrogen in the steam which is recorded upon the Cambridge Dissolved Hydrogen Recorder. Cambridge Analyzers are available in models for continuously recording either O_2 or H_2 separately or O_2 and H_2 simultaneously.

Send for Bulletin 148 B.P.

CAMBRIDGE INSTRUMENT CO., INC.

3767 Grand Central Terminal New York 17, N. Y.

CAMBRIDGE
DISSOLVED O_2 & H_2 ANALYZERS

PIONEER MANUFACTURERS OF PRECISION INSTRUMENTS

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Specified for More Jobs than any other small forged steel gate valve

CHAPMAN List 960

Chapman List 960 is specified for more different applications than any other small forged steel gate valve in the world. Engineers know that List 960 valves keep maintenance expenses low under the most severe service conditions.

Seizing and galling are virtually eliminated, because wedge gate faces are superhardened to 800 Brinell. Stainless steel seat rings, hardened to minimize wear, are easy to replace, make it unnecessary to lap-in gate and seats. Stem guide passages are carefully machined to minimize stresses, keep operation smooth and trouble-free over long periods. Stem-and-gate connection is extra strong where extreme stresses can develop.

For every application you have for small forged steel gate valves, specify Chapman List 960. Sizes from ¼″ to 2″. Rising stem with yoke (shown) or rising stem with inside screw. Metal-to-metal or gasketed bonnet joint, depending on application. Pressure range to 2000 pounds at 100°F, to 380 pounds at 1000°F. For higher pressures, specify List 990. Write for your copy of Catalog 10 now.

The Chapman Valve Manufacturing Co.
INDIAN ORCHARD, MASSACHUSETTS

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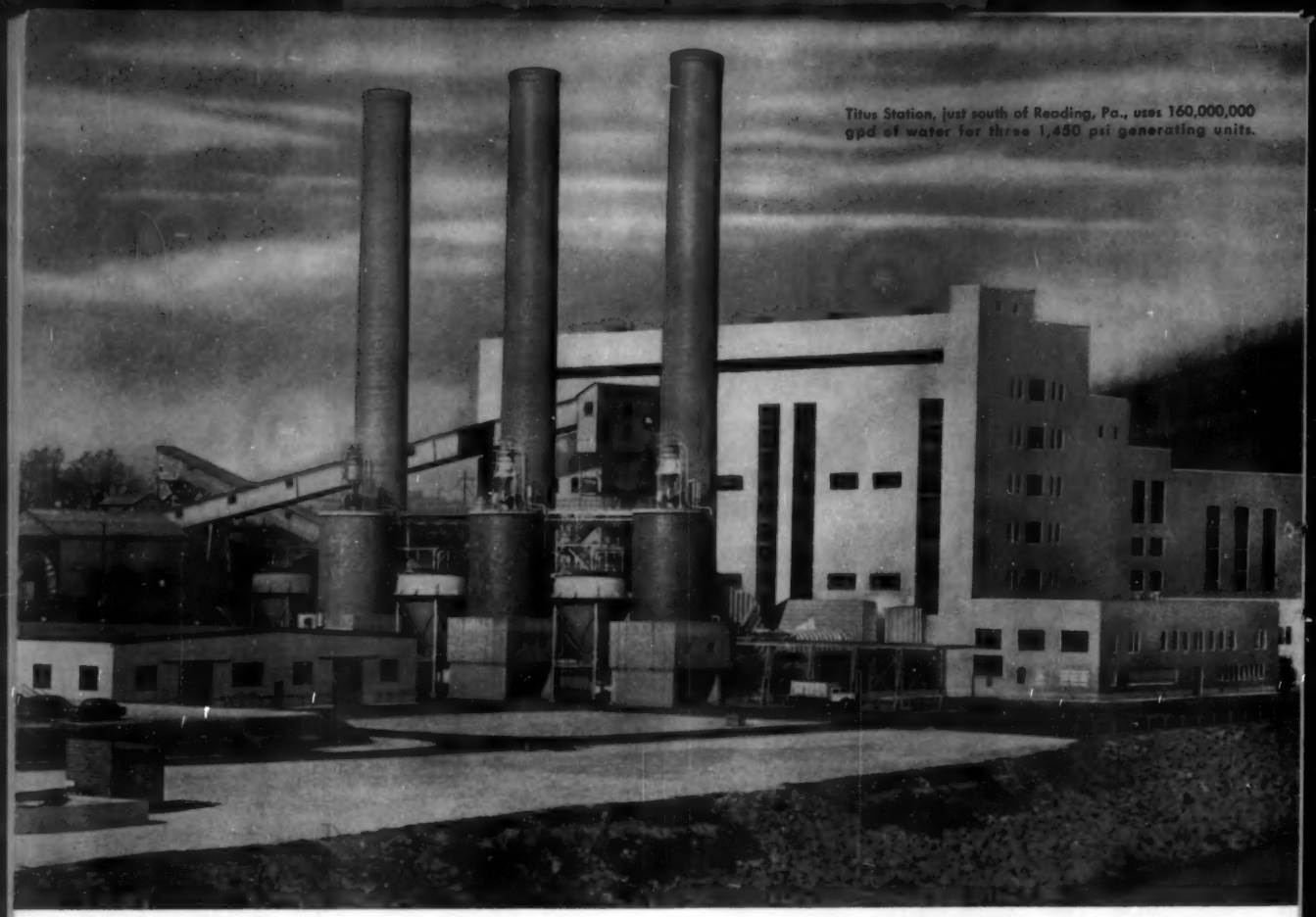

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METROPOLITAN EDISON BOOSTS CAPACITY BY 240,000 KW!

Latest $35,000,000 investment is protected by Permutit-conditioned water

Sheathed in aluminum—this silver giant is the last word in reliability and design.

Titus Station's output almost equals that of 5 other Metropolitan Edison Company stations. Permutit was selected to protect this important plant from untreated Schuylkill River water . . . turbidity of 700 ppm, hardness up to 180 ppm, high iron and manganese.

Two Permutit Precipitators remove trouble-making suspended solids, give clarified water for bearing cooling, oil coolers, etc. Part of this water goes on to Permutit filters and softeners . . . comes out crystal clear and completely softened for more critical uses.

You can get this same protection for your plant. We will be glad to supply helpful information on your particular water problems. Write today.

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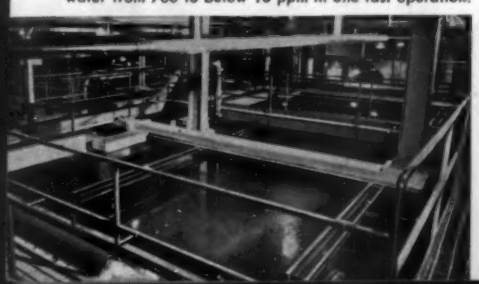
PERMUTIT®

Water Conditioning Headquarters for Over 40 Years

PRECIPITATORS reduce turbidity of Schuylkill River water from 700 to below 10 ppm in one fast operation.



GRAVITY FILTERS remove final traces of suspended impurities . . . using Anthrafilt to eliminate silica pick-up.

AUTOMATIC SOFTENERS deliver *completely softened* water. Regeneration is automatic . . . saves time and money.